

Valerio Bertacchi


UNIVERSITÀ DEGLI STUDI DI MILANO

selezione pubblica per n. 1 posto/i di Ricercatore a tempo determinato in tenure track (RTT),
per il settore concorsuale 02/A1 - FISICA SPERIMENTALE DELLE INTERAZIONI FONDAMENTALI,
settore scientifico-disciplinare FIS/01 - FISICA SPERIMENTALE FIS/04 - FISICA NUCLEARE E SUBNUCLEARE
presso il Dipartimento di Fisica Aldo Pontremoli,
(avviso bando pubblicato sulla G.U. n. 16 del 23/02/2024) Codice concorso 5495

INFORMAZIONI PERSONALI

Cognome: Bertacchi **Nome:** Valerio

✉ valerio.bertacchi@gmail.com bertacchi@cppm.in2p3.fr

 **ORCID** [0000-0001-9971-1176](https://orcid.org/0000-0001-9971-1176)

Data di nascita 7 March 1993 | **Nazionalità** Italiana

PROFILO

- Ricercatore postdoc in fisica delle particelle con esperienza nelle collaborazioni di fisica ad alta energia (Belle II, CMS).
- Esperienza in analisi dati nelle misure di precisione del Modello Standard e nelle misure dei decadimenti del mesone B .
- Competenze nello sviluppo di software di tracking e in machine learning.
- Esperienza hardware sui rivelatori al silicio

TITOLI DI STUDIO

Nov. 2017 –Lug. 2021	Dottorato di ricerca in Fisica Scuola Normale Superiore di Pisa, Italia (INFN-Pisa, gruppo di CMS) Voto finale: <i>Cum Laude</i> Tesi Towards a simultaneous measurement of W boson mass and production properties with the CMS detector Relatore Gigi Rolandi	EQF level 8
Ott. 2015 – Ott. 2017	Laurea Magistrale in Fisica Piano di studi in fisica sperimentale delle alte energie Università di Pisa, Italia Voto finale: 110/110 <i>Cum Laude</i> Tesi Development and performance of the track finder for the Belle II Vertex Detector Relatore Francesco Forti Correlatore: Eugenio Paoloni (INFN-Pisa, gruppo di Belle II)	EQF level 7
Ott. 2012 – Sett. 2015	Laura triennale in Fisica Università di Pisa, Italia Voto finale: 110/110 <i>Cum Laude</i> Tesi Track finding in un collisionatore adronico e FastTrackR Relatore Mauro Dell'Orso	EQF level 6
Set. 2007 – Lug. 2012	Maturità Scientifica Liceo Scientifico F. Buonarroti, Pisa, Italia Voto Finale: 100/100 <i>Cum Laude</i>	EQF level 4

ESPERIENZE LAVORATIVE

Set 2021– Set. 2024	Postdoc Centre de Physique des Particules de Marseille (CPPM), CNRS/IN2P3, Marsiglia, Francia Progetto NEPAL: New Physics searches with Tau Leptons (ERC Consolidator Grant 2018) Capo gruppo Justine Serrano
---------------------	--

Set. 2021– Feb. 2023 **Ricercatore Visiting**

Laboratoire de Physique des 2 Infinis Irène Joliot Curie (IJCLab), CNRS/IN2P3, Orsay, Francia
 Capo gruppo Karim Trabelsi

Nov. 2019 – Feb. 2020 **Docente esterno per supporto alla didattica**

Università di Pisa, Italia

Lug. 2016 – Set. 2016 **Internship a Fermilab – Programma Summer Student INFN-FNAL 2016**

Fermilab National Accelerator Laboratory, Illinois, USA
 Progetto **Preliminary studies of proton reconstruction at Mu2e**
 Supervisor Pavel Murat

ATTIVITÀ DIDATTICA E DI TUTORAGGIO

2022-presente Supervisione di una studentessa di dottorato dell'università Aix-Marseille/CNRS per l'analisi di $B \rightarrow K^{*0} \tau \ell$ ($\ell = e, \mu$) e attività legate al tracking in Belle II. L'attività di tutoraggio è cominciata all'inizio del dottorato della studentessa e proseguirà fino al termine del mio contratto al CPPM, coprendo quindi 2 anni.

2022 Supervisione di uno studente magistrale dell'Università di Paris-Saclay per l'analisi di $B \rightarrow D^{(*)} K^- K^{(*)0}$ sui dati di Belle. L'attività di tutoraggio ha coperto i 3 mesi di internship dello studente nel gruppo di Belle II. Anno Accademico: 2021-2022.

2021 Tutor per il 1° e il 2° Hackathon di Machine Learning dell'INFN nel 2021. L'attività ha coperto la durata degli hackaton (2 giorni ciascuno), più le settimane precedenti per la preparazione degli esercizi, dell'infrastruttura tecnologica necessaria e il coordinamento con gli altri tutor.

1 Nov.2019 - 28 Feb.2020 Attività di supporto alla didattica per il corso di "Fisica Generale" del corso di laurea in Ingegneria dell'Energia dell'Università di Pisa. L'attività è consistita in esercitazioni e sessioni di ricevimento dedicate (20 ore totali). Questa attività didattica è stata svolta durante il dottorato, con un contratto di collaborazione esterna dell'Università di Pisa. Professore di ruolo del corso: Alberto Maria Messineo. Anno Accademico: 2019-2020.

2017 Tutor per gli studenti del primo anno della Scuola Normale Superiore per il corso di "Complementi di Meccanica Classica e Termodinamica". L'attività è consistita in esercitazioni e sessioni di ricevimento dedicate (1 ora la settimana per il primo semestre, per un totale di di circa 20 ore). Questa attività fa parte dei regolari compiti degli studenti di dottorato della Scuola Normale Superiore, quindi non corrisponde a un contratto di lavoro dedicato. Professore di ruolo del corso: Gigi Rolandi. Anno Accademico: 2017-2018.

ATTIVITÀ DI RICERCA

2023-presente [Collaborazione Belle II] Sono parte del gruppo di *Data Production* di Belle II come **Skim Manager**, incaricato della gestione e dello sviluppo delle selezioni grezze, necessarie alla preselezione e della categorizzazione dei dati e delle simulazioni Monte Carlo (MC) di Belle II. Le *skim* sono uno strumento cruciale per analizzare efficientemente i dati di Belle II. Date le crescenti luminosità integrate, la gestione dei sample di dati e MC può essere un fattore limitante per gli analisti. Le *skim* aiutano a mantenere sotto controllo le dimensioni dei sample di dati e MC per velocizzare le procedure di analisi. Con il Run 2 di Belle II diventeranno un passaggio indispensabile per ciascuna analisi di Belle II.

- 2022-presente** [Collaborazione Belle II] Sto lavorando alla misura dei *branching fractions* dei **decadimenti** $B \rightarrow D^{(*)} K K_{(S)}^{(*)0}$. Questo settore è relativamente inesplorato e solo una frazione dei decadimenti di questo sono stati misurati precedentemente. Questi decadimenti possono essere usati come ulteriori canali esclusivi di *B-tagging* o come settore inclusivo di *B-tagging*. Inoltre è di particolare interesse lo studio del piano di Dalitz di questi decadimenti, dato che sono state evidenziate **strutture risonanti**. Un risultato preliminare è stato presentato ai Rencontres de Moriond QCD 2023 con l'osservazione di tre nuovi canali di decadimento. L'analisi completa, di cui sono l'autore principale, è attualmente in fase di revisione interna ed è stata presentata ai Rencontres de Physique de la Vallée d'Aoste 2024. La pubblicazione dell'analisi completa è prevista entro l'estate 2024.
- 2021-presente** [Collaborazione Belle II] Sto conducendo, all'interno del progetto ERC "NEPAL" di Justine Serrano, la ricerca di decadimenti rari e a **violazione di sapore leptonic (LFV)** con almeno un τ nello stato finale. In particolare, sto lavorando alla ricerca di $B^0 \rightarrow K^{*0} \tau \ell$ su dati di Belle e Belle II. Questa ricerca non è mai stata eseguita negli stati finali degli elettroni, mentre c'è solo un limite superiore stabilito dalla collaborazione LHCb per gli stati finali dei muoni. La pubblicazione è prevista per l'inverno 2024-2025. Precedentemente ho collaborato con il gruppo di IJCLab alla ricerca dei decadimenti $B^+ \rightarrow K^+ \tau \ell$ effettuata sui dati di Belle.
- 2021-2023** [Collaborazione Belle II] Mi sono occupato dello sviluppo di nuovi algoritmi di ***B-tagging*** nella Collaborazione Belle II. I decadimenti con energia mancante nello stato finale vengono ricostruiti tramite *B-tagging*: viene identificato il secondo mesone B (*tag*) prodotto coerentemente al mesone B di segnale, per inferire quindi le proprietà di quest'ultimo. Mi sono occupato di migliorare le performance di *B-tagging* sviluppando nuove tecniche di ricostruzione. In particolare mi sono concentrato sulla possibilità di ricostruire parzialmente il mesone di *tag*, utilizzando signature caratteristiche, in modo da aumentare l'efficienza di *B-tagging*, invece di ricostruirlo tramite canali esclusivi.
- 2021-2023** [Collaborazione Belle II] Mi sono occupato ottimizzare il software di **track-fitting** utilizzato nel trigger software di alto livello (**HLT**). Le procedure di fitting consumano una frazione rilevante del tempo a disposizione del trigger e mi sono accorto che vi era la possibilità di ridurlo senza degradare le performance modificando opportunamente l'algoritmo di fit. Così facendo sono riuscito a ridurre del 20% il tempo di fit. Questo tipo di ottimizzazione è particolarmente importante dato l'aumento di luminosità previsto a Belle II che ridurrà ulteriormente il tempo a disposizione del trigger. Grazie a questi studi sono stato inserito nella lista degli autori di Belle II.
- 2017-2021** [Collaborazione CMS] Mi sono occupato della misura della **massa del bosone W** (m_W) nel canale $W^\pm \rightarrow \mu^\pm \nu$. La limitata conoscenza dei dettagli della produzione del bosone W , in termini di distribuzione in impulso trasverso (q_T^W), rapidità (Y_W) e polarizzazione del bosone, induce un'incertezza sistematica sul valore della massa. Nella mia tesi di PhD ho sviluppato un metodo per la misura simultanea di m_W , q_T^W , Y_W e polarizzazione, da poter ottenere una **misura di m_W senza effettuare assunzioni teoriche sul modello di produzione**. Nello specifico, m_W , q_T^W , Y_W e 5 coefficienti angolari possono essere estratti dalle sole distribuzioni cinematiche del muone utilizzando un *template fit* (η^μ, p_T^μ) in bin di q_T^W , Y_W e per ogni coefficiente angolare.
- Per gestire la complessità di questa analisi, con ordine di 10^3 *template* e 10^9 eventi da processare per la stima del segnale e dei background, è stato necessario un framework dedicato al quale ho contribuito allo sviluppo. Tale framework è basato sulle librerie di ROOT **RDataFrame** e permette un alto livello di parallelizzazione. Ho anche realizzato la misura dei background utilizzando un approccio basato sui dati stessi che sfrutta la diversa distribuzione del segnale e dei background in funzione dell'isolamento del muone e della massa trasversa dell'evento.
- Ho effettuato un'analisi fenomenologica su un possibile impatto secondario delle **Parton Distribution Functions** sulle misure di massa dei bosoni vettori. La moda della distribuzione in massa invariante, a causa dell'andamento della luminosità partonica, risulta spostata rispetto al polo della Breit-Wigner ideale. Tale spostamento, se non opportunamente sotto controllo, può indurre un'incertezza sistematica sull'estrazione del valore della massa. Lo studio è stato presentato a IFAE 2019 e ha portato a una pubblicazione indipendente.

Ho contribuito allo sviluppo del *template fit*, concentrandomi in particolare sulle tecniche di regolarizzazione del fit per migliorarne stabilità e precisione. Nella mia tesi di dottorato la misura è *blinded*, quindi il fit finale è stato eseguito sulla simulazione. Questo perché, nonostante la tesi abbia ottenuto l'*endorsement* di CMS, l'analisi non era ancora pronta per la pubblicazione al momento della conclusione del mio dottorato. Ciononostante, le simulazioni effettuate su un campione equivalente ai dati raccolti da CMS nel 2016 dimostrano come, con l'approccio sviluppato nella mia tesi, sia possibile ottenere incertezze sistematiche dovute al modello di produzione trascurabili, pur garantendo un'incertezza statistica al di sotto dei 10 MeV su m_W . Altro risultato rilevante è la possibilità di ottenere una misura dello spettro in q_T^W con precisione 4%-8% con una granularità di 2 GeV. I risultati sono documentati in una nota interna.

- 2017-2021** [Collaborazione CMS] Sono stato parte del gruppo di tracking di CMS e in particolare ho investigato le problematiche del tracking in ambienti ad alta occupanza, come nel *core* dei jet ad alta energia, dove ricostruzione è inefficiente. Il punto critico è la suddivisione e l'assegnazione dei cluster alle tracce, problematico a causa dell'alta densità. Sono il principale sviluppatore di una **Convolutional Neural Network**, chiamata Deep Core, in grado di produrre efficientemente i parametri di traccia dei *seed* necessari come punto di partenza dell'algoritmo di tracking di tutte le tracce presenti nella regione centrale del jet direttamente dall'informazione grezza dei pixel. L'algoritmo sviluppato mostra prestazioni molto promettenti, è stato integrato nel software di ricostruzione CMS nel 2021 ed è attualmente utilizzato per la presa dati del Run 3 dell'LHC. Grazie al lavoro svolto nell'ambito del gruppo di tracking sono stato inserito nella lista degli autori di CMS. Inoltre ero designato come figura di contatto tra il gruppo di Tracking e il gruppo di Machine Learning di CMS.
- 2019-2021** [Collaborazione CMS] Ho collaborato con il gruppo di CMS Pisa alla configurazione del sistema DAQ per i test dei moduli del tracker esterno di CMS per l'upgrade ad HL-LHC.
- 2016-2017** [Collaborazione Belle II] Durante la mia tesi magistrale partecipato ho collaborato con il gruppo di Belle II di Pisa alla costruzione del Silicon Vertex Detector (SVD). In particolare ho lavorato alla **caratterizzazione elettrica dei rivelatori al silicio** (*strip detector* a doppia faccia).
Ho partecipato a un **test beam** ai laboratori di DESY nel 2017, dove un intero settore del tracciatore è stato testato su un fascio di elettroni da 6 GeV. L'obiettivo del *test beam* era testare i moduli di SVD con la completa catena di acquisizione, trigger e software di tracking. Durante il *testbeam* ho studiato le performance di ricostruzione e ha effettuato la misura della *hit efficiency* dei sensori dell'SVD.
- 2016-2017** [Collaborazione Belle II] Sono stato parte del gruppo di tracking di Belle II, collaborando alla riscrittura del **Vertex Detector Track Finder** (VXDTF2) di Belle II, l'algoritmo di ricostruzione nel tracker interno. In particolare ho ottimizzato il sample di allenamento per la Sector Map (una *lookup-table* contenente le informazioni geometriche dei pattern delle tracce) e ho sviluppato un algoritmo per identificare e scartare le tracce influenzati da scattering multiplo.
- 2016-2017** [Collaborazione Belle II] Ho effettuato studi preliminari sulla simulazione di Belle II per la misura di $R(D^{(*)})$, nel gruppo dei decadimenti semitaunici del mesone B .
- 2016** [Collaborazione Mu2e] Ho effettuato studi preliminari per consentire l'uso dell'algoritmo di tracking di Mu2e per ricostruire i protoni e sfruttarli per il monitoraggio del flusso di muoni a scala temporale del millisecondo. Questa ricerca si è svolta durante il mio internship a Fermilab.

COLLABORAZIONI INTERNAZIONALI

- 2021-presente** Affiliazione alla Collaborazione Belle II. Come membro di Belle II partecipo e presento la mia ricerca regolarmente a riunioni di gruppi locali o globali, con frequenti viaggi e periodi di permanenza ai laboratori di KEK. La mia attività di ricerca all'interno della collaborazione è sottoposta a processi di revisione e interna, documentata in note interne. Svolgo attività tecniche, non direttamente volte a pubblicazione, ma necessarie alla collaborazione. Esempi sono turni nella sala di controllo di Belle II in fase di presa dati, lo sviluppo di software di collaborazione o la revisione interna degli articoli di Belle II. Dal 2021 sono parte della lista degli autori di Belle II.

2017-2022 Affiliazione alla Collaborazione CMS. Come membro di CMS II ho partecipato e presentato la mia ricerca regolarmente a riunioni di gruppi locali o globali, con frequenti viaggi e periodi di permanenza ai laboratori del CERN. La mia attività di ricerca all'interno della collaborazione è stata sottoposta a processi di revisione e interna, documentata in note interne. Ho svolto attività tecniche, non direttamente volte a pubblicazione, ma necessarie alla collaborazione. Esempi lo sviluppo di software di collaborazione o la revisione interna degli articoli di CMS. Nel periodo 2018-2022 sono stato parte della lista degli autori di CMS.

2016-2018 Affiliazione alla Collaborazione Belle II. Analogamente a quanto detto sopra. Nel 2017 i miei contributi tecnici sono stati prevalentemente dedicati alla costruzione del tracciatore di Belle II e lo sviluppo di software di collaborazione.

ATTIVITÀ DI COORDINAMENTO E GESTIONE DI PROGETTI

2023-presente Belle II skim manager. Questo ruolo richiede la gestione and sviluppo delle skim (le selezioni grezze necessarie per la preselezione e la categorizzazione dei dati e simulazioni Monte Carlo di Belle II), la manutenzione del relativo codice di collaborazione, i rapporti con le figure di contatto con i gruppi di fisica, i contatti e il coordinamento con il resto del gruppo di *Data Production* e con il management di Belle II. Questo ruolo è attualmente condiviso con un co-manager mio pari.

2020-2021 Figura di contatto tra il gruppo di Tracking e il gruppo di Machine Learning di CMS. Questo ruolo richiedeva la gestione delle comunicazioni tra i due gruppi e la gestione delle richieste di supporto da parte degli sviluppatori di software dei due gruppi.

PARTECIPAZIONE A PROGETTI DI RICERCA

2021- presente Partecipazione al progetto ERC Consolidator Grant 2018 "NEPAL" (NEw Physics searches with tAu Leptons) in quanto ricercatore postdoc (Principal Investigator: Justine Serrano). Partecipo alla attività delle ricerca del progetto che presento regolarmente agli incontri dedicati e supervisiono gli studenti di dottorato coinvolti.

2023-presente Partecipazione alle attività del "Toshiko Yuasa Laboratory - France-Japan Particle Physics Laboratory" (FYL-FJPPL). Questo gruppo di ricerca lega i ricercatori francesi e giapponesi in ambito nella fisica delle particelle. Il gruppo si occupa di organizzare workshop e seminari ai quali ho partecipato e presentato regolarmente.

2021- presente Partecipazione al gruppo di ricerca francese "GDR - Intensity frontier". Questo gruppo di ricerca lega i ricercatori in ambito sperimentale e teorico dei vari istituti di ricerca francesi che lavorano su fisica del *flavour*. Il gruppo si occupa di organizzare workshop, seminari e incontri di formazione. Ho partecipato e presentato regolarmente a questi incontri.

2017- 2021 Partecipazione al PRIN 2017F28R78 "Precision Electroweak Physics at the CERN Large Hadron Collider" in quanto studente di dottorato (Principal Investigator: Gigi Rolandi). Ho partecipato alla attività delle ricerca del progetto, ho presentato regolarmente le mie ricerche alle riunioni del progetto.

CONFERENZE

Conferenze Organizzate Orsay 2023 W mass workshop, Orsay, 23-24 Febbraio 2023 ([link alla pagina indico](#))

Presentazioni a Conferenze Internazionali o Nazionali

- *Recent beauty measurements from Belle and Belle II* (a La Thuile - Les Rencontres de Physique de la Vallée d'Aoste, La Thuile - Italia, 2024)
- *Measurement of the branching fractions of $B \rightarrow D^{(*)} K^- K_{(S)}^{(*)0}$ decays in Belle II* (a GDR - Intensity Frontier 2023 Annual workshop, Strasburgo - Francia, 2023)
- *Belle II status and prospects for studies of neutral currents* (a New Frontiers in Lepton Flavor, Pisa - Italia, 2023)
- *Electroweak penguin, hadronic, and time-dependent decays at Belle II* (a Rencontres de Moriond '23, La Thuile - Italy, 2023)
- *High Level Trigger of Belle II experiment* (a GDR - Intensity Frontier 2022 Annual workshop, Lione - Francia, 2022)
- *Recent result from Belle II* (a QCD 22, Montpellier - Francia, 2022)
- *Impact of PDF on the invariant mass distribution of W and Z bosons* (a Incontri di Fisica delle Alte Energie, Napoli - Italia, 2019)
- *DeepCore: Convolutional Neural Network for high p_T jet tracking* (a Connecting the Dots and Workshop on Intelligent Trackers, Valencia - Spain, 2019)

Seminari e ulteriori presentazioni

- *Towards a simultaneous measurement of W boson mass and production properties with CMS detector* (al Milano-Pisa meeting "Precision Electroweak Physics at the CERN Large Hadron Collider" - PRIN 2017F28R78, Milano - Italia, 2020)
- *Estimation of multijet background for the W measurement* (al Kick-off meeting "Precision Electroweak Physics at the CERN Large Hadron Collider" - PRIN 2017F28R78, Pisa - Italia, 2020)
- Tutti i seminari e le presentazioni interne alle collaborazioni CMS e Belle II, tenuti durante incontri locali (italiani, francesi) o globali (CMS Weeks, Belle II General meeting), sono omessi

Poster presentati

- *Measurement of the branching fraction of $B \rightarrow D^{(*)} K^- K^{(*)0}$ and $B \rightarrow D^{(*)} D_s^-$ decays using the 2019–2022 Belle II data sample* (Poster interno di Belle II presentato al 46th Belle II general meeting, 2023, KEK-Japan)
- *High- p_T jet tracking using Convolutional Neural Network* (Poster interno di CMS presentato alla CMS Week, 2018, Budapest-Ungheria)

Partecipazione a Scuole e Workshop

- GDR - Intensity Frontier 2023 Annual workshop, Strasburgo, 6-8 Novembre 2023
- GDR - Intensity Frontier 2022 Annual workshop, Lione, 2-4 Novembre 2022
- Milano-Pisa meeting "Precision Electroweak Physics at the CERN Large Hadron Collider" - PRIN 2017F28R78, Milano, 5-6 Ottobre 2021
- GDR - Intensity Frontier 2021 Annual workshop, Parigi, 15-17 Novembre 2021
- PyHEP 2020 Workshop, virtuale, 13-17 Luglio 2020
- Kick-off meeting "Precision Electroweak Physics at the CERN Large Hadron Collider" - PRIN 2017F28R78, Pisa, 7 Febbraio 2020
- Belle II VXD Open Workshop, CERN, 8-10 Luglio 2019
- Giornate Studio sui Rivelatori, Scuola F. Bonaudi, Cogne, 11-15 Febbraio 2019
- CMS Data Analysis School, Pisa, 28 Gennaio-1 Febbraio 2019
- Pisa School on Future Collider, 17-21 Settembre 2018
- First Electroweak Symmetry Breaking Spring School, Maratea, 15-21 Aprile 2018

Partecipazioni a ulteriori conferenze

- Connecting The Dots 2020, virtuale, 22-24 Aprile 2020
- Rencontres de Moriond '19, Electroweak session, La Thuile, 16-23 Marzo 2019

PREMI E BORSE DI RICERCA

2022 Premio di Benvenuto della Città di Marsiglia per i nuovi ricercatori provenienti da istituzioni esterne (premio di 2mila euro)

2017-2021 Borsa di Dottorato Scuola Normale Superiore of Pisa (circa 52mila euro totali)

2016 Borsa di ricerca a Fermilab, all'interno del programma Summer Student del 2016 INFN-FNAL, ottenuto grazie ai meriti universitari (3.4mila dollari di borsa di ricerca)

2016 (*rifiutato per la sovrapposizione con la borsa di ricerca a Fermilab*) Borsa di ricerca a SLAC, all'interno del programma Summer Student di SLAC del 2016, ottenuto grazie ai meriti universitari

2013 Premio "Alberto Ottolenghi" della federazione italiana "Maestri del Lavoro", ottenuto grazie ai meriti di studio durante la scuola superiore

ATTIVITÀ DI REVISIONE

2021-presente Revisore interno delle pubblicazioni di Belle II

2018-2021 Revisore interno delle pubblicazioni di CMS

2017-2021 Revisore per *NIMA (Nuclear Instruments and Methods in Physics Research, Sec. A)*

ATTIVITÀ DI DIVULGAZIONE

- Seminario *Introduzione alla fisica delle particelle* (2020, al Liceo Scientifico Cecioni di Livorno)
- Presentazione a "l'Angolo dei Ricercatori" (durante l'evento "Bright Toscana 2019 – la notte delle ricercatrici e dei ricercatori")
- Seminario *Tra vertici e Tracce – un viaggio nella fisica delle particelle* (durante l'evento "Bright Toscana 2018 – la notte delle ricercatrici e dei ricercatori")
- Guida durante il tour delle camere pulite dell'INFN-Pisa (durante l'evento "Bright Toscana 2017 – la notte delle ricercatrici e dei ricercatori")

REFERENZE

Belle II spokesperson Karim Trabelsi, direttore di ricerca a IJCLab, Orsay, karim.trabelsi@in2p3.fr

Relatore di dottorato Gigi Rolandi, Professore ordinario alla Scuola Normale Superiore of Pisa, luigi.rolandi@sns.it

**Relatore di tesi magistrale
Thesis supervisor** Francesco Forti, Professore ordinario all'University of Pisa, francesco.forti@pi.infn.it

COMPETENZE PERSONALI

Abilità Linguistiche – Italiano: lingua madre
– Inglese: C1, Certificati: Trinity GESE level 9

Competenze Digitali – Linguaggi di Programmazione: C, C++, Python
– Librerie Specifiche: ROOT, Keras, basi di Tensorflow, basi di RDataFrame, basi CMS Combine
– Linguaggi Editoriali: LaTeX
– Software di grafica: CorelDraw
– Licenza ECDL (Microsoft Office e sistema operativo Windows)

Ulteriori competenze legate alla fisica – Elettronica: progettazione, utilizzo e debug di circuiti elettronici (analogici e digitali).
– Fisica Teorica: teoria quantistica dei campi, basi del Modello Standard, basi di relatività generale, fisica dello stato solido.

Ulteriori ruoli di gestione e rappresentanza – Rappresentante della Cité Universitaire: rappresentante dei residenti presso la *Maison de l'Italie* della *Cité Internationale Universitaire de Paris*.
– Rappresentante di istituto: esperienza nella gestione di assemblee formali o informali della scuola, come rappresentante di istituto presso il mio liceo.
– Capo scout (CNGEI, l'associazione scout laica italiana): ho ricoperto il ruolo di responsabile per 30 adolescenti per due anni durante la mia esperienza scout, dove ho imparato come lavorare e mediare con i giovani, come organizzare grandi eventi (come campo di formazione di alcune settimane) e come trovare soluzioni in caso di difficoltà impreviste.

PUBBLICAZIONI

- Parametri Bibliometrici** **Web of Science:** H-index: 26, Num. tot. citazioni: 2944, Num. medio di citazioni per articolo: 10.05
INSPIRE-HEP: H-index: 66, Num. tot. citazioni: 15936, Num. medio citazioni per articolo: 46.3
 (parametri aggiornati al 20/03/2024)
- Pubblicazioni su Rivista**
- Pubblicazioni con CMS : 325 pubblicazioni all'interno della lista degli autori della Collaborazione CMS (si veda [INSPIRE-HEP](#) per l'elenco completo), che includono:
 - CMS Collaboration, *Measurements of the W boson rapidity, helicity, double-differential cross sections, and charge asymmetry in pp collisions at $\sqrt{s} = 13$ TeV*, Phys.Rev.D **102** (2020) 9, 092012, DOI: [10.1103/PhysRevD.102.092012](#)
 - Pubblicazioni con Belle II: 60 pubblicazione all'interno della lista degli autori della Collaborazione Belle II (si veda [INSPIRE-HEP](#) per l'elenco completo), che includono:
 - Abudinén F. et al (Belle II Collaboration), *Observation of $B \rightarrow D^{(*)} K^- K_S^0$ decays using the 2019–2022 Belle II data sample*, [arXiv:2305.01321 \[hep-ex\]](#) (2023)
 - Adamczyk K. et al. (Belle II SVD Collaboration), *The design, construction, operation and performance of the Belle II silicon vertex detector*, JINST **17** (2022) 11, P11042, DOI:[10.1088/1748-0221/17/11/P11042](#)
 - Bertacchi V. et al. (Belle II tracking group) *Track Finding at Belle II*, Comput.Phys.Commun. **259** (2021), 107610 DOI: [10.1016/j.cpc.2020.107610](#)
 - Bertacchi V. et al., *Impact of the PDFs on the Z and W lineshapes at LHC*, Eur. Phys. J. C **80** (2020) 4, 328, DOI: [10.1140/epjc/s10052-020-7892-z](#)
- Resoconti di Conferenze**
- V. Bertacchi (on behalf of Belle II Collaboration), *Belle II status and prospects for studies of neutral currents*, JINST **18** (2023) 08, C08015, DOI:[10.1088/1748-0221/18/08/C08015](#)
 - V. Bertacchi (on behalf of Belle II Collaboration), *Time-dependent, hadronic B decays and electro-weak penguins at Belle II*, in "Proceedings of the 57th Rencontres de Moriond - 2023 QCD and High Energy Interactions", DOI: [10.58027/gdmm-nw65](#)
 - V. Bertacchi (on behalf of Belle II Collaboration), *Recent result from Belle II*, Nucl. Part. Phys. Proc. **324-329** (2023) 107-112, DOI:[10.1016/j.nuclphysbps.2023.01.022](#)
 - V. Bertacchi, *Impact of the PDFs on the Z and W lineshapes at LHC*, Nuovo Cim. C **43** (2020) 2-3, 28, DOI:[10.1393/ncc/i2020-20028-1](#)
 - V. Bertacchi (on behalf of CMS Collaboration), *DeepCore: Convolutional Neural Network for high p_T jet tracking*. [arXiv:1910.08058 \[physics.ins-det\]](#) (2019)
- Note interne**
- V. Bertacchi, K. Trabelsi, *Measurement of the branching fraction of $B \rightarrow D^{(*)} K^- K^{(*)0}$ and $B \rightarrow D^{(*)} D_s^-$ decays using the 2019–2022 Belle II data sample*, 2023, BELLE2-NOTE-PH-2023-030 (Belle II Internal note)
 - V. Bertacchi, K. Trabelsi, *Observation of $B \rightarrow D^{(*)} K^- K_S^0$ decays using the 2019-2022 Belle II data sample*, 2023, BELLE2-NOTE-PH-2023-002 (Belle II Internal note)
 - G. De Marino, K. Trabelsi, V. Vobbilisetti, V. Bertacchi *Modelling of the charged B decays used in hadronic B-tagging*, 2022, BELLE2-NOTE-PH-2022-002 (Belle II Internal note)
 - V. Bertacchi et al. *Towards a simultaneous measurement of W boson mass and production properties with the CMS detector*, 2021, CMS AN-20-210 (CMS Analysis Note)
 - CMS Collaboration, *DeepCore: Convolutional Neural Network for high p_T jet tracking*, 2019, CMS DP -2019/007 (CMS Detector Performance Summary)
 - V. Bertacchi et al., *Definition of the Training Sample for the VXDTF2*, 2017, BELLE2-NOTE-TE-2018-003, (Belle II Internal Note)
 - V. Bertacchi, *Preliminary studies of the proton reconstruction*, 2016, Mu2e-doc8261-v1, (Mu2e Internal Note)
- Tesi**
- Tesi di dottorato: V. Bertacchi, *Towards a simultaneous measurement of W boson mass and production properties with the CMS detector*, [CERN-THESIS-2021-100](#), 2021 (ha ricevuto l'endorsement di CMS)
 - Tesi di laurea magistrale: V. Bertacchi, *Development and performance of the track finder for the Belle II Vertex Detector*, [BELLE2-MTHESIS-2018-001](#), 2017
- Lista completa delle pubblicazioni** **INSPIRE-HEP profile:** V.Bertacchi.1 ([INSPIRE-HEP link](#))

CONTRIBUTO
PERSONALE ALLE 12
PUBBLICAZIONI
SELEZIONATE

- 1 Bertacchi V. et al., *Impact of the PDFs on the Z and W lineshapes at LHC*, Eur. Phys. J. C 80 (2020) 4, 328, [arXiv:1909.07935 \[hep-ex\]](#), DOI: [10.1140/epjc/s10052-020-7892-z](#)
Contributo personale: Sono il principale autore dell'intero articolo e dell'intera analisi presentata nello stesso. La necessità dello studio dell'articolo è emersa all'interno del gruppo di CMS - Pisa coinvolto nella misura della massa del bosone W (di cui sono membri gli altri autori dell'articolo), ma sono sviluppato io i dettagli del metodo di analisi e la sua realizzazione. La scrittura dell'articolo è stata curata da me, con suggerimenti e integrazioni da parte degli altri autori. Ho curato infine l'interazione con i revisori e l'editore nel processo di pubblicazione.

- 2 Bertacchi V. et al. (Belle II tracking group), *Track Finding at Belle II*, Comput. Phys. Commun. 259 (2021), 107610, [arXiv:2003.12466 \[physics.ins-det\]](#) DOI: [10.1016/j.cpc.2020.107610](#)
Contributo personale: Ha contribuito alla scrittura e la validazione di parte del software di ricostruzione descritto nell'articolo. In particolare mi sono occupato della definizione del *training sample* utilizzato per allenare la *sector map* del *vertex detector track finder* (VXDTF2), responsabile della produzione dei *track-seed* con la sola informazione del tracciatore in silicio di Belle 2 (SVD). Ho inoltre testato il VXDTF2 durante un testbeam che ha rappresentato il primo test del software su dati reali.

- 3 Sirunyan A. M. et al. (CMS Collaboration), *Measurements of the W boson rapidity, helicity, double-differential cross sections, and charge asymmetry in pp collisions at $\sqrt{s} = 13$ TeV*, Phys. Rev. D 102 (2020) 9, 092012, [arXiv:2008.04174 \[hep-ex\]](#), DOI: [10.1103/PhysRevD.102.092012](#)
Contributo personale: Ho partecipato attivamente alle discussioni con i principali autori dell'analisi, in fase di sviluppo dell'analisi, di interpretazione dei risultati di revisione interna. Tale misura è infatti strettamente legata al lavoro del gruppo CMS - Pisa coinvolto nella misura della massa del bosone W , di cui ho fatto parte e in particolare al lavoro presentato nella mia tesi di dottorato.

- 4 Adamczyk K. et al. (Belle II SVD Collaboration), *The design, construction, operation and performance of the Belle II silicon vertex detector*, JINST 17 (2022) 11, P11042, [arXiv:2201.09824 \[physics.ins-det\]](#), DOI: [10.1088/1748-0221/17/11/P11042](#)
Contributo personale: Ho contribuito alla costruzione e la valutazione delle performance del rivelatore descritto nell'articolo. In particolare ho contribuito con la caratterizzazione elettrica dei moduli dell'SVD, al test su fascio in fase di testbeam, e la misura della *hit efficiency* degli dei moduli.

- 5 Bertacchi V. (on behalf of Belle II Collaboration), *Belle II status and prospects for studies of neutral currents*, JINST 18 (2023) 08, C08015, [arXiv:2307.04928 \[hep-ex\]](#), DOI: [10.1088/1748-0221/18/08/C08015](#)
Contributo personale: Questo articolo rappresenta i *proceeding* del lavoro che ho presentato alla conferenza "New Frontiers in Lepton Flavor" (Pisa, 2023). Sono il solo autore dell'articolo.

- 6 Adachi, I. et al. (Belle II Collaboration), *Measurement of branching fractions and direct CP asymmetries for $B \rightarrow K\pi$ and $B \rightarrow \pi\pi$ decays at Belle II*, Phys. Rev. D 109 (2024) 1, 012001, [arXiv:2310.06381 \[hep-ex\]](#), DOI: [10.1103/PhysRevD.109.012001](#)
Contributo personale: Ho partecipato alla revisione interna di tale articolo in quanto revisore interno istituzionale di Belle II.

- 7 Adachi, I. et al. (Belle II Collaboration), *Evidence for $B^+ \rightarrow K^+ \nu \bar{\nu}$ Decays*, Belle II Preprint 2023-017, [arXiv:2311.14647 \[hep-ex\]](#) (2023)
Nota: L'articolo non è stato ancora pubblicato, ma è stato accettato per la pubblicazione su Physical Review D.
Contributo personale: Il lavoro presentato nell'articolo è stato discusso e presentato nello stesso gruppo di lavoro di Belle II di cui faccio parte. Ho quindi partecipato alle discussioni con i principali autori dell'analisi, in fase di sviluppo dell'analisi e di interpretazione dei risultati. Ho partecipato inoltre alla revisione interna dell'articolo.
- 8 Abudinén F. et al. (Belle II Collaboration), *Measurement of the B^0 lifetime and flavor-oscillation frequency using hadronic decays reconstructed in 2019-2021 Belle II data*, Phys. Rev. D 107 (2023) 9, L091102, [arXiv: 2302.12791 \[hep-ex\]](#), DOI: [10.1103/PhysRevD.107.L091102](#)
Contributo personale: Ho partecipato alla revisione interna di tale articolo in quanto revisore interno istituzionale di Belle II.
- 9 Sirunyan A. M. et al. (CMS Collaboration), *Evidence for Higgs boson decay to a pair of muons*, J. High Energ. Phys. 2021, 148 (2021), [arXiv:2009.04363 \[hep-ex\]](#), DOI: [10.1007/JHEP01\(2021\)148](#)
Contributo personale: Questa analisi è stata sviluppata nel gruppo CMS - Pisa di cui ho fatto parte. Ho quindi partecipato alle discussioni in fase di analisi e interpretazione dei risultati. Ho partecipato alla revisione interna.
- 10 Sirunyan A. M. et al. (CMS Collaboration), *Observation of the Production of Three Massive Gauge Bosons at $\sqrt{s} = 13$ TeV*, Phys. Rev. Lett. 125 (2020) 151802, [arXiv: 2006.11191 \[hep-ex\]](#), DOI: [10.1103/PhysRevLett.125.151802](#)
Contributo personale: Ho partecipato alla revisione interna di tale articolo in quanto revisore interno istituzionale di CMS.
- 11 Sirunyan A. M. et al. (CMS Collaboration), *Combined search for supersymmetry with photons in proton-proton collisions at $\sqrt{s} = 13$ TeV*, Phys. Lett. B 801 (2020) 135183, [arXiv: 1907.00857 \[hep-ex\]](#), DOI: [10.1016/j.physletb.2019.135183](#)
Contributo personale: Ho partecipato alla revisione interna di tale articolo in quanto revisore interno istituzionale di CMS.
- 12 Bertacchi V., *Towards a simultaneous measurement of W boson mass and production properties with the CMS detector*, CERN-THESIS-2021-100, 2021, Tesi di PhD con endorsement della Collaborazione CMS
Contributo personale: tesi di dottorato del sottoscritto. L'analisi è stata svolta con la collaborazione dei gruppi CMS-Pisa e CERN, principalmente. L'analisi è presentata *blinded* perchè la misura della massa del bosone W non era ancora pronta per la pubblicazione al momento della discussione della tesi.

A seguire la lista completa delle pubblicazioni

- [1] I. Adachi et al., "Search for a $\mu^+ \mu^-$ resonance in four-muon final states at Belle II", (2024), [arXiv:2403.02841 \[hep-ex\]](#).
- [2] I. Adachi et al., "Measurement of CP asymmetries in $B^0 \rightarrow K_S^0 K_S^0 K_S^0$ decays at Belle II", (2024), [arXiv:2403.02590 \[hep-ex\]](#).
- [3] I. Adachi et al., "A new graph-neural-network flavor tagger for Belle II and measurement of $\sin 2\phi_1$ in $B^0 \rightarrow J/\psi K_S^0$ decays", (2024), [arXiv:2402.17260 \[hep-ex\]](#).
- [4] A. Tumasyan et al., "Search for a scalar or pseudoscalar dilepton resonance produced in association with a massive vector boson or top quark-antiquark pair in multilepton events at $\sqrt{s} = 13$ TeV", (2024), [arXiv:2402.11098 \[hep-ex\]](#).
- [5] I. Adachi et al., "Measurement of CP asymmetries in $B^0 \rightarrow \eta' K_S^0$ decays at Belle II", (2024), [arXiv:2402.03713 \[hep-ex\]](#).

- [6] I. Adachi et al., “Study of $\Upsilon(10753)$ decays to $\pi^+\pi^-\Upsilon(nS)$ final states at Belle II”, (2024), arXiv:2401.12021 [hep-ex].
- [7] I. Adachi et al., “A test of lepton flavor universality with a measurement of $R(D^*)$ using hadronic B tagging at the Belle II experiment”, (2024), arXiv:2401.02840 [hep-ex].
- [8] I. Adachi et al., “Search for the $e^+e^- \rightarrow \eta_b(1S)\omega$ and $e^+e^- \rightarrow \chi_{b0}(1P)\omega$ processes at $\sqrt{s} = 10.745$ GeV”, (2023), arXiv:2312.13043 [hep-ex].
- [9] A. Tumasyan et al., “Measurement of simplified template cross sections of the Higgs boson produced in association with W or Z bosons in the $H \rightarrow b\bar{b}$ decay channel in proton-proton collisions at $\sqrt{s} = 13$ TeV”, (2023), arXiv:2312.07562 [hep-ex].
- [10] I. Adachi et al., “Evidence for $B^+ \rightarrow K^+\nu\bar{\nu}$ Decays”, (2023), arXiv:2311.14647 [hep-ex].
- [11] A. Tumasyan et al., “Higher-order moments of the elliptic flow distribution in PbPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, JHEP **2024**, 106 (2024), arXiv:2311.11370 [nucl-ex].
- [12] I. Adachi et al., “First measurement of $R(X_{\tau/\ell})$ as an inclusive test of the $b \rightarrow c\tau\nu$ anomaly”, (2023), arXiv:2311.07248 [hep-ex].
- [13] A. Tumasyan et al., “Search for high-mass exclusive diphoton production with tagged protons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, (2023), arXiv:2311.02725 [hep-ex].
- [14] A. Tumasyan et al., “Search for central exclusive production of top quark pairs in proton-proton collisions at $\sqrt{s} = 13$ TeV with tagged protons”, (2023), arXiv:2310.11231 [hep-ex].
- [15] I. Adachi et al., “Measurement of branching fractions and direct CP asymmetries for $B \rightarrow K\pi$ and $B \rightarrow \pi\pi$ decays at Belle II”, Phys. Rev. D **109**, 012001 (2024), arXiv:2310.06381 [hep-ex].
- [16] A. Tumasyan et al., “Study of azimuthal anisotropy of $\Upsilon(1S)$ mesons in pPb collisions at $s_{NN} = 8.16$ TeV”, Phys. Lett. B **850**, 138518 (2024), arXiv:2310.03233 [hep-ex].
- [17] I. Adachi et al., “Determination of $|V_{cb}|$ using $B^-0 \rightarrow D^{*+}\ell^- \nu^- \ell$ decays with Belle II”, Phys. Rev. D **108**, 092013 (2023), arXiv:2310.01170 [hep-ex].
- [18] A. Tumasyan et al., “Search for a new resonance decaying into two spin-0 bosons in a final state with two photons and two bottom quarks in proton-proton collisions at $\sqrt{s} = 13$ TeV”, (2023), arXiv:2310.01643 [hep-ex].
- [19] I. Adachi et al., “Measurement of branching-fraction ratios and CP asymmetries in $B^\pm \rightarrow D_{CP\pm} K^\pm$ decays at Belle and Belle II”, (2023), arXiv:2308.05048 [hep-ex].
- [20] A. Tumasyan et al., “Measurement of the production cross section for a W boson in association with a charm quark in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **84**, 27 (2024), arXiv:2308.02285 [hep-ex].
- [21] I. Adachi et al., “Tests of Light-Lepton Universality in Angular Asymmetries of $B_0 \rightarrow D^{*-}\ell^+\nu$ Decays”, Phys. Rev. Lett. **131**, 181801 (2023), arXiv:2308.02023 [hep-ex].
- [22] A. Tumasyan et al., “Multiplicity and transverse momentum dependence of charge-balance functions in pPb and PbPb collisions at LHC energies”, (2023), arXiv:2307.11185 [nucl-ex].
- [23] A. Tumasyan et al., “Study of charm hadronization with prompt Λ_c^+ baryons in proton-proton and lead-lead collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, JHEP **01**, 128 (2024), arXiv:2307.11186 [nucl-ex].
- [24] A. Tumasyan et al., “Search for Z’ bosons decaying to pairs of heavy Majorana neutrinos in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **11**, 181 (2023), arXiv:2307.06959 [hep-ex].
- [25] V. Bertacchi, “Belle II status and prospects for studies of neutral currents”, JINST **18**, C08015 (2023), arXiv:2307.04928 [hep-ex].
- [26] I. Adachi et al., “Measurement of CP asymmetries in $B_0 \rightarrow \phi K_S 0$ decays with Belle II”, Phys. Rev. D **108**, 072012 (2023), arXiv:2307.02802 [hep-ex].
- [27] I. Adachi et al., “Search for a $\tau^+\tau^-$ resonance in $e^+e^- \rightarrow \mu^+\mu^-\tau^+\tau^-$ events with the Belle II experiment”, Phys. Rev. Lett. **131**, 121802 (2023), arXiv:2306.12294 [hep-ex].
- [28] A. Tumasyan et al., “Two-particle Bose-Einstein correlations and their Lévy parameters in PbPb collisions at $s_{NN}=5.02$ TeV”, Phys. Rev. C **109**, 024914 (2024), arXiv:2306.11574 [nucl-ex].
- [29] A. Tumasyan et al., “Performance of the local reconstruction algorithms for the CMS hadron calorimeter with Run 2 data”, JINST **18**, P11017 (2023), arXiv:2306.10355 [hep-ex].

- [30] I. Adachi et al., “Measurement of CP asymmetries and branching-fraction ratios for $B^\pm \rightarrow DK^\pm$ and $D\pi^\pm$ with $D \rightarrow K_S^0 K^\pm \pi^\pm$ using Belle and Belle II data”, JHEP **09**, 146 (2023), arXiv:2306.02940 [hep-ex].
- [31] I. Adachi et al., “Search for a long-lived spin-0 mediator in $b \rightarrow s$ transitions at the Belle II experiment”, Phys. Rev. D **108**, L111104 (2023), arXiv:2306.02830 [hep-ex].
- [32] I. Adachi et al., “Precise Measurement of the Ds^+ Lifetime at Belle II”, Phys. Rev. Lett. **131**, 171803 (2023), arXiv:2306.00365 [hep-ex].
- [33] I. Adachi et al., “Measurement of the τ -lepton mass with the Belle II experiment”, Phys. Rev. D **108**, 032006 (2023), arXiv:2305.19116 [hep-ex].
- [34] A. Tumasyan et al., “Measurements of the azimuthal anisotropy of prompt and nonprompt charmonia in PbPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, JHEP **10**, 115 (2023), arXiv:2305.16928 [hep-ex].
- [35] A. Tumasyan et al., “Search for resonances in events with photon and jet final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **12**, 189 (2023), arXiv:2305.07998 [hep-ex].
- [36] I. Adachi et al., “Measurement of CP Violation in $B^0 \rightarrow KS^0 \pi^0$ Decays at Belle II”, Phys. Rev. Lett. **131**, 111803 (2023), arXiv:2305.07555 [hep-ex].
- [37] V. Bertacchi, “Time-dependent, hadronic B decays and electroweak penguins at Belle II”, in 57th Rencontres de Moriond on QCD and High Energy Interactions (mag. 2023), arXiv:2305.07175 [hep-ex].
- [38] F. Abudinén et al., “Search for lepton-flavor-violating $\tau^- \rightarrow \ell^- \phi$ decays in 2019-2021 Belle II data”, (2023), arXiv:2305.04759 [hep-ex].
- [39] F. Abudinén et al., “Observation of $B \rightarrow D^{(*)} K^- K_S^0$ decays using the 2019-2022 Belle II data sample”, (2023), arXiv:2305.01321 [hep-ex].
- [40] A. Tumasyan et al., “Search for top squark pair production in a final state with at least one hadronically decaying tau lepton in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 110 (2023), arXiv:2304.07174 [hep-ex].
- [41] I. Adachi et al., “Novel method for the identification of the production flavor of neutral charmed mesons”, Phys. Rev. D **107**, 112010 (2023), arXiv:2304.02042 [hep-ex].
- [42] A. Tumasyan et al., “Observation of the $\Upsilon(3S)$ meson and suppression of Υ states in PbPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, (2023), arXiv:2303.17026 [hep-ex].
- [43] A. Tumasyan et al., “Probing Small Bjorken-x Nuclear Gluonic Structure via Coherent J/ψ Photoproduction in Ultraperipheral Pb-Pb Collisions at $s_{NN}=5.02$ TeV”, Phys. Rev. Lett. **131**, 262301 (2023), arXiv:2303.16984 [nucl-ex].
- [44] A. Tumasyan et al., “First measurement of the top quark pair production cross section in proton-proton collisions at $\sqrt{s} = 13.6$ TeV”, JHEP **08**, 204 (2023), arXiv:2303.10680 [hep-ex].
- [45] F. Abudinén et al., “Measurement of the branching fraction and CP asymmetry of $B^0 \rightarrow \pi^0 \pi^0$ decays using 198×10^6 BB^- pairs in Belle II data”, Phys. Rev. D **107**, 112009 (2023), arXiv:2303.08354 [hep-ex].
- [46] A. Tumasyan et al., “Evidence for four-top quark production in proton-proton collisions at $s=13$ TeV”, Phys. Lett. B **844**, 138076 (2023), arXiv:2303.03864 [hep-ex].
- [47] A. Tumasyan et al., “A search for decays of the Higgs boson to invisible particles in events with a top-antitop quark pair or a vector boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **83**, 933 (2023), arXiv:2303.01214 [hep-ex].
- [48] F. Abudinén et al., “Measurement of the B^0 lifetime and flavor-oscillation frequency using hadronic decays reconstructed in 2019–2021 Belle II data”, Phys. Rev. D **107**, L091102 (2023), arXiv:2302.12791 [hep-ex].
- [49] A. Tumasyan et al., “Search for a vector-like quark $T' \rightarrow tH$ via the diphoton decay mode of the Higgs boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **09**, 057 (2023), arXiv:2302.12802 [hep-ex].
- [50] I. Adachi et al., “Measurement of decay-time-dependent CP violation in $B^0 \rightarrow J/\psi K_S^0$ decays using 2019-2021 Belle II data”, (2023), arXiv:2302.12898 [hep-ex].
- [51] V. Bertacchi, “Recent results from Belle II”, Nucl. Part. Phys. Proc. **324-329**, 107–112 (2023).
- [52] A. Tumasyan et al., “Measurement of the top quark mass using a profile likelihood approach with the lepton + jets final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **83**, 963 (2023), arXiv:2302.01967 [hep-ex].
- [53] A. Tumasyan et al., “Search for top squarks in the four-body decay mode with single lepton final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **06**, 060 (2023), arXiv:2301.08096 [hep-ex].

- [54] L. Aggarwal et al., “Test of Light-Lepton Universality in the Rates of Inclusive Semileptonic B-Meson Decays at Belle II”, Phys. Rev. Lett. **131**, 051804 (2023), arXiv:2301.08266 [hep-ex].
- [55] A. Tumasyan et al., “First measurement of the forward rapidity gap distribution in pPb collisions at sNN=8.16 TeV”, Phys. Rev. D **108**, 092004 (2023), arXiv:2301.07630 [hep-ex].
- [56] F. Abudinén et al., “Measurement of the $B^0 \rightarrow D^{*-}\ell^+\nu_\ell$ branching ratio and $|V_{cb}|$ with a fully reconstructed accompanying B meson in 2019-2021 Belle II data”, (2023), arXiv:2301.04716 [hep-ex].
- [57] A. Tumasyan et al., “Measurement of the electroweak production of $W\gamma$ in association with two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **108**, 032017 (2023), arXiv:2212.12592 [hep-ex].
- [58] A. Tumasyan et al., “Search for new physics in the τ lepton plus missing transverse momentum final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **09**, 051 (2023), arXiv:2212.12604 [hep-ex].
- [59] A. Tumasyan et al., “Measurement of the $B_S^0 \rightarrow \mu^+\mu^-$ decay properties and search for the $B^0 \rightarrow \mu^+\mu^-$ decay in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **842**, 137955 (2023), arXiv:2212.10311 [hep-ex].
- [60] A. Tumasyan et al., “Search for long-lived particles using out-of-time trackless jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 210 (2023), arXiv:2212.06695 [hep-ex].
- [61] I. Adachi et al., “Search for Lepton-Flavor-Violating τ Decays to a Lepton and an Invisible Boson at Belle II”, Phys. Rev. Lett. **130**, 181803 (2023), arXiv:2212.03634 [hep-ex].
- [62] I. Adachi et al., “Search for an Invisible Z' in a Final State with Two Muons and Missing Energy at Belle II”, Phys. Rev. Lett. **130**, 231801 (2023), arXiv:2212.03066 [hep-ex].
- [63] A. Tumasyan et al., “Measurement of the dependence of the hadron production fraction ratio f_s/f_u and f_d/f_u on B meson kinematic variables in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **131**, 121901 (2023), arXiv:2212.02309 [hep-ex].
- [64] A. Tumasyan et al., “Measurements of azimuthal anisotropy of nonprompt D0 mesons in PbPb collisions at sNN=5.02TeV”, Phys. Lett. B **850**, 138389 (2024), arXiv:2212.01636 [nucl-ex].
- [65] A. Tumasyan et al., “Search for high-mass exclusive $\gamma\gamma \rightarrow WW$ and $\gamma\gamma \rightarrow ZZ$ production in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 229 (2023), arXiv:2211.16320 [hep-ex].
- [66] F. Abudinén et al., “Reconstruction of $B \rightarrow \rho\ell\nu_\ell$ decays identified using hadronic decays of the recoil B meson in 2019 – 2021 Belle II data”, (2022), arXiv:2211.15270 [hep-ex].
- [67] A. Tumasyan et al., “Search for Higgs Boson and Observation of Z Boson through their Decay into a Charm Quark-Antiquark Pair in Boosted Topologies in Proton-Proton Collisions at s=13 TeV”, Phys. Rev. Lett. **131**, 041801 (2023), arXiv:2211.14181 [hep-ex].
- [68] A. Tumasyan et al., “Search for supersymmetry in final states with a single electron or muon using angular correlations and heavy-object identification in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **09**, 149 (2023), arXiv:2211.08476 [hep-ex].
- [69] A. Tumasyan et al., “Measurement of the differential $t\bar{t}$ production cross section as a function of the jet mass and extraction of the top quark mass in hadronic decays of boosted top quarks”, Eur. Phys. J. C **83**, 560 (2023), arXiv:2211.01456 [hep-ex].
- [70] A. Tumasyan et al., “Azimuthal correlations in Z +jets events in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **83**, 722 (2023), arXiv:2210.16139 [hep-ex].
- [71] F. Abudinén et al., “Determination of $|V_{cb}|$ from $B \rightarrow D\ell\nu$ decays using 2019-2021 Belle II data”, (2022), arXiv:2210.13143 [hep-ex].
- [72] A. Tumasyan et al., “Measurements of jet multiplicity and jet transverse momentum in multijet events in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **83**, 742 (2023), arXiv:2210.13557 [hep-ex].
- [73] F. Abudinén et al., “Measurement of the photon-energy spectrum in inclusive $B \rightarrow X_s\gamma$ decays identified using hadronic decays of the recoil B meson in 2019-2021 Belle II data”, (2022), arXiv:2210.10220 [hep-ex].
- [74] A. Tumasyan et al., “Search for medium effects using jets from bottom quarks in PbPb collisions at sNN=5.02TeV”, Phys. Lett. B **844**, 137849 (2023), arXiv:2210.08547 [hep-ex].
- [75] A. Tumasyan et al., “Azimuthal anisotropy of dijet events in PbPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, JHEP **07**, 139 (2023), arXiv:2210.08325 [hep-ex].
- [76] A. Tumasyan et al., “Proton reconstruction with the CMS-TOTEM Precision Proton Spectrometer”, JINST **18**, P09009 (2023), arXiv:2210.05854 [hep-ex].

- [77] K. Adamczyk et al., “Determination of $|V_{ub}|$ from untagged $B^0 \rightarrow \pi^- \ell^+ \nu_\ell$ decays using 2019-2021 Belle II data”, (2022), arXiv:2210.04224 [hep-ex].
- [78] A. Tumasyan et al., “Search for a heavy composite Majorana neutrino in events with dilepton signatures from proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Lett. B **843**, 137803 (2023), arXiv:2210.03082 [hep-ex].
- [79] A. Tumasyan et al., “Search for new heavy resonances decaying to WW, WZ, ZZ, WH, or ZH boson pairs in the all-jets final state in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Lett. B **844**, 137813 (2023), arXiv:2210.00043 [hep-ex].
- [80] F. Abudinén et al., “Measurement of decay-time dependent CP violation in $B^0 \rightarrow K_S^0 K_S^0 K_S^0$ using 2019–2021 Belle II data”, (2022), arXiv:2209.09547 [hep-ex].
- [81] A. Tumasyan et al., “Search for pair production of vector-like quarks in leptonic final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 020 (2023), arXiv:2209.07327 [hep-ex].
- [82] A. Tumasyan et al., “Search for exotic Higgs boson decays $H \rightarrow \mathcal{A}\mathcal{A} \rightarrow 4\gamma$ with events containing two merged diphotons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **131**, 101801 (2023), arXiv:2209.06197 [hep-ex].
- [83] F. Abudinén et al., “Measurement of the branching fractions and CP asymmetries of $B^+ \rightarrow \pi^+ \pi^0$ and $B^+ \rightarrow K^+ \pi^0$ decays in 2019-2021 Belle II data”, (2022), arXiv:2209.05154 [hep-ex].
- [84] I. Adachi et al., “Observation of $e^+e^- \rightarrow \omega \chi_{bJ}(1P)$ and Search for $X_b \rightarrow \omega \Upsilon(1S)$ at \sqrt{s} near 10.75 GeV”, Phys. Rev. Lett. **130**, 091902 (2023), arXiv:2208.13189 [hep-ex].
- [85] A. Tumasyan et al., “Search for new physics using effective field theory in 13 TeV pp collision events that contain a top quark pair and a boosted Z or Higgs boson”, Phys. Rev. D **108**, 032008 (2023), arXiv:2208.12837 [hep-ex].
- [86] A. Tumasyan et al., “Measurement of the Higgs boson inclusive and differential fiducial production cross sections in the diphoton decay channel with pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 091 (2023), arXiv:2208.12279 [hep-ex].
- [87] A. Tumasyan et al., “Search for pair-produced vector-like leptons in final states with third-generation leptons and at least three b quark jets in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Lett. B **846**, 137713 (2023), arXiv:2208.09700 [hep-ex].
- [88] F. J. Abudinen et al., “Measurement of the $\Omega c0$ lifetime at Belle II”, Phys. Rev. D **107**, L031103 (2023), arXiv:2208.08573 [hep-ex].
- [89] A. Tumasyan et al., “Measurement of the cross section of top quark-antiquark pair production in association with a W boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 219 (2023), arXiv:2208.06485 [hep-ex].
- [90] F. Abudinén et al., “Measurement of Branching Fraction and Longitudinal Polarization in $B^0 \rightarrow \rho^+ \rho^-$ Decays at Belle II”, (2022), arXiv:2208.03554 [hep-ex].
- [91] A. Tumasyan et al., “Measurement of the $t\bar{t}$ charge asymmetry in events with highly Lorentz-boosted top quarks in pp collisions at $\sqrt{s}=13$ TeV”, Phys. Lett. B **846**, 137703 (2023), arXiv:2208.02751 [hep-ex].
- [92] A. Tumasyan et al., “Searches for additional Higgs bosons and for vector leptoquarks in $\tau\tau$ final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 073 (2023), arXiv:2208.02717 [hep-ex].
- [93] A. Tumasyan et al., “Search for CP violation in $t\bar{t}H$ and tH production in multilepton channels in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 092 (2023), arXiv:2208.02686 [hep-ex].
- [94] A. Tumasyan et al., “Search for the exotic decay of the Higgs boson into two light pseudoscalars with four photons in the final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 148 (2023), arXiv:2208.01469 [hep-ex].
- [95] A. Tumasyan et al., “Measurement of inclusive and differential cross sections for single top quark production in association with a W boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 046 (2023), arXiv:2208.00924 [hep-ex].
- [96] A. Tumasyan et al., “Search for the Higgs boson decay to a pair of electrons in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Lett. B **846**, 137783 (2023), arXiv:2208.00265 [hep-ex].
- [97] A. Tumasyan et al., “Search for new physics in the lepton plus missing transverse momentum final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 067 (2022), arXiv:2202.06075 [hep-ex].
- [98] A. Tumasyan et al., “Measurement of the top quark pole mass using $t\bar{t}$ +jet events in the dilepton final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 077 (2023), arXiv:2207.02270 [hep-ex].

- [99] A. Tumasyan et al., “Search for direct pair production of supersymmetric partners of τ leptons in the final state with two hadronically decaying τ leptons and missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Phys. Rev. D* **108**, 012011 (2023), arXiv:2207.02254 [hep-ex].
- [100] A. Tumasyan et al., “Search for a charged Higgs boson decaying into a heavy neutral Higgs boson and a W boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **09**, 032 (2023), arXiv:2207.01046 [hep-ex].
- [101] F. Abudinén et al., “Measurement of the Λ_c^+ Lifetime”, *Phys. Rev. Lett.* **130**, 071802 (2023), arXiv:2206.15227 [hep-ex].
- [102] A. Tumasyan et al., “A portrait of the Higgs boson by the CMS experiment ten years after the discovery.”, *Nature* **607**, 60–68 (2022), arXiv:2207.00043 [hep-ex].
- [103] F. Abudinén et al., “Angular analysis of $B^+ \rightarrow \rho^+ \rho^0$ decays reconstructed in 2019, 2020, and 2021 Belle II data”, (2022), arXiv:2206.12362 [hep-ex].
- [104] A. Tumasyan et al., “Search for Higgs boson pairs decaying to WW^*WW^* , $WW^*\tau\tau$, and $\tau\tau\tau\tau$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **07**, 095 (2023), arXiv:2206.10268 [hep-ex].
- [105] A. Tumasyan et al., “Search for nonresonant Higgs boson pair production in the four leptons plus twob jets final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **06**, 130 (2023), arXiv:2206.10657 [hep-ex].
- [106] A. Tumasyan et al., “Search for resonant and nonresonant production of pairs of dijet resonances in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **07**, 161 (2023), arXiv:2206.09997 [hep-ex].
- [107] A. Tumasyan et al., “Measurements of the Higgs boson production cross section and couplings in the W boson pair decay channel in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Eur. Phys. J. C* **83**, 667 (2023), arXiv:2206.09466 [hep-ex].
- [108] A. Tumasyan et al., “Search for nonresonant Higgs boson pair production in final state with two bottom quarks and two tau leptons in proton-proton collisions at $s=13$ TeV”, *Phys. Lett. B* **842**, 137531 (2023), arXiv:2206.09401 [hep-ex].
- [109] A. Tumasyan et al., “Probing Heavy Majorana Neutrinos and the Weinberg Operator through Vector Boson Fusion Processes in Proton-Proton Collisions at $s=13$ TeV”, *Phys. Rev. Lett.* **131**, 011803 (2023), arXiv:2206.08956 [hep-ex].
- [110] F. Abudinén et al., “Study of Exclusive $B \rightarrow \pi e^+ \nu_e$ Decays with Hadronic Full-event-interpretation Tagging in 189.3 fb^{-1} of Belle II Data”, (2022), arXiv:2206.08102 [hep-ex].
- [111] F. Abudinén et al., “Measurement of the branching fraction of the $B^0 \rightarrow K_S^0 \pi^0 \gamma$ decay using 190 fb^{-1} of Belle II data”, (2022), arXiv:2206.08280 [hep-ex].
- [112] A. Tumasyan et al., “Precision measurement of the Z boson invisible width in pp collisions at $s=13$ TeV”, *Phys. Lett. B* **842**, 137563 (2023), arXiv:2206.07110 [hep-ex].
- [113] A. Tumasyan et al., “Observation of τ lepton pair production in ultraperipheral lead-lead collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, *Phys. Rev. Lett.* **131**, 151803 (2023), arXiv:2206.05192 [nucl-ex].
- [114] A. Tumasyan et al., “Search for Higgs boson decays into Z and J/ψ and for Higgs and Z boson decays into J/ψ or Y pairs in pp collisions at $s=13$ TeV”, *Phys. Lett. B* **842**, 137534 (2023), arXiv:2206.03525 [hep-ex].
- [115] A. Tumasyan et al., “Observation of same-sign WW production from double parton scattering in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Phys. Rev. Lett.* **131**, 091803 (2023), arXiv:2206.02681 [hep-ex].
- [116] G. Aad et al., “Combination of inclusive top-quark pair production cross-section measurements using ATLAS and CMS data at $\sqrt{s} = 7$ and 8 TeV”, *JHEP* **07**, 213 (2023), arXiv:2205.13830 [hep-ex].
- [117] A. Tumasyan et al., “Search for electroweak production of charginos and neutralinos at $s=13$ TeV in final states containing hadronic decays of WW, WZ, or WH and missing transverse momentum”, *Phys. Lett. B* **842**, 137460 (2023), arXiv:2205.09597 [hep-ex].
- [118] A. Tumasyan et al., “Search for long-lived particles decaying to a pair of muons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **05**, 228 (2023), arXiv:2205.08582 [hep-ex].
- [119] A. Tumasyan et al., “Search for CP violating top quark couplings in pp collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **07**, 023 (2023), arXiv:2205.07434 [hep-ex].
- [120] A. Tumasyan et al., “Search for heavy resonances and quantum black holes in $e\mu$, $e\tau$, and $\mu\tau$ final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **05**, 227 (2023), arXiv:2205.06709 [hep-ex].

- [121] A. Tumasyan et al., “Search for Nonresonant Pair Production of Highly Energetic Higgs Bosons Decaying to Bottom Quarks”, *Phys. Rev. Lett.* **131**, 041803 (2023), arXiv:2205.06667 [hep-ex].
- [122] A. Tumasyan et al., “Search for Higgs Boson Decay to a Charm Quark-Antiquark Pair in Proton-Proton Collisions at $\sqrt{s}=13$ TeV”, *Phys. Rev. Lett.* **131**, 061801 (2023), arXiv:2205.05550 [hep-ex].
- [123] A. Tumasyan et al., “Observation of electroweak $W+W-$ pair production in association with two jets in proton-proton collisions at $\sqrt{s}=13$ TeV”, *Phys. Lett. B* **841**, 137495 (2023), arXiv:2205.05711 [hep-ex].
- [124] A. Tumasyan et al., “Measurement of the mass dependence of the transverse momentum of lepton pairs in Drell-Yan production in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Eur. Phys. J. C* **83**, 628 (2023), arXiv:2205.04897 [hep-ex].
- [125] A. Tumasyan et al., “Constraints on anomalous Higgs boson couplings to vector bosons and fermions from the production of Higgs bosons using the $\tau\tau$ final state”, *Phys. Rev. D* **108**, 032013 (2023), arXiv:2205.05120 [hep-ex].
- [126] A. Tumasyan et al., “Measurement of differential cross sections for the production of a Z boson in association with jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Phys. Rev. D* **108**, 052004 (2023), arXiv:2205.02872 [hep-ex].
- [127] A. Tumasyan et al., “CMS pythia 8 colour reconnection tunes based on underlying-event data”, *Eur. Phys. J. C* **83**, 587 (2023), arXiv:2205.02905 [hep-ex].
- [128] A. Tumasyan et al., “Search for CP violation using $t\bar{t}$ events in the lepton+jets channel in pp collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **06**, 081 (2023), arXiv:2205.02314 [hep-ex].
- [129] A. Tumasyan et al., “Search for narrow resonances in the b-tagged dijet mass spectrum in proton-proton collisions at $\sqrt{s}=13$ TeV”, *Phys. Rev. D* **108**, 012009 (2023), arXiv:2205.01835 [hep-ex].
- [130] A. Tumasyan et al., “Azimuthal Correlations within Exclusive Dijets with Large Momentum Transfer in Photon-Lead Collisions”, *Phys. Rev. Lett.* **131**, 051901 (2023), arXiv:2205.00045 [nucl-ex].
- [131] A. Tumasyan et al., “Strange hadron collectivity in pPb and PbPb collisions”, *JHEP* **05**, 007 (2023), arXiv:2205.00080 [nucl-ex].
- [132] A. Tumasyan et al., “Two-particle azimuthal correlations in γp interactions using pPb collisions at $\sqrt{s_{NN}}=8.16$ TeV”, *Phys. Lett. B* **844**, 137905 (2023), arXiv:2204.13486 [nucl-ex].
- [133] A. Tumasyan et al., “Search for light Higgs bosons from supersymmetric cascade decays in pp collisions at $\sqrt{s} = 13$ TeV”, *Eur. Phys. J. C* **83**, 571 (2023), arXiv:2204.13532 [hep-ex].
- [134] A. Tumasyan et al., “Search for Higgs boson decays to a Z boson and a photon in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **05**, 233 (2023), arXiv:2204.12945 [hep-ex].
- [135] A. Tumasyan et al., “Measurements of Higgs boson production in the decay channel with a pair of τ leptons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Eur. Phys. J. C* **83**, 562 (2023), arXiv:2204.12957 [hep-ex].
- [136] A. Tumasyan et al., “Reconstruction of decays to merged photons using end-to-end deep learning with domain continuation in the CMS detector”, *Phys. Rev. D* **108**, 052002 (2023), arXiv:2204.12313 [hep-ex].
- [137] A. Tumasyan et al., “Search for a massive scalar resonance decaying to a light scalar and a Higgs boson in the four b quarks final state with boosted topology”, *Phys. Lett. B* **842**, 137392 (2023), arXiv:2204.12413 [hep-ex].
- [138] A. Tumasyan et al., “Search for new particles in an extended Higgs sector with four b quarks in the final state at $\sqrt{s}=13$ TeV”, *Phys. Lett. B* **835**, 137566 (2022), arXiv:2203.00480 [hep-ex].
- [139] A. Tumasyan et al., “Search for a W' boson decaying to a vector-like quark and a top or bottom quark in the all-jets final state at $\sqrt{s} = 13$ TeV”, *JHEP* **09**, 088 (2022), arXiv:2202.12988 [hep-ex].
- [140] A. Tumasyan et al., “Measurement of the Drell-Yan forward-backward asymmetry at high dilepton masses in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **2022**, 063 (2022), arXiv:2202.12327 [hep-ex].
- [141] A. Tumasyan et al., “Nuclear modification of Υ states in pPb collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, *Phys. Lett. B* **835**, 137397 (2022), arXiv:2202.11807 [hep-ex].
- [142] A. Tumasyan et al., “Search for Higgs Boson Pair Production in the Four b Quark Final State in Proton-Proton Collisions at $\sqrt{s}=13$ TeV”, *Phys. Rev. Lett.* **129**, 081802 (2022), arXiv:2202.09617 [hep-ex].
- [143] A. Tumasyan et al., “Inclusive nonresonant multilepton probes of new phenomena at $\sqrt{s}=13$ TeV”, *Phys. Rev. D* **105**, 112007 (2022), arXiv:2202.08676 [hep-ex].
- [144] A. Tumasyan et al., “Measurement of the Higgs boson width and evidence of its off-shell contributions to ZZ production”, *Nature Phys.* **18**, 1329–1334 (2022), arXiv:2202.06923 [hep-ex].

- [145] A. Tumasyan et al., “Search for invisible decays of the Higgs boson produced via vector boson fusion in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Rev. D **105**, 092007 (2022), arXiv:2201.11585 [hep-ex].
- [146] K. Adamczyk et al., “The design, construction, operation and performance of the Belle II silicon vertex detector”, JINST **17**, P11042 (2022), arXiv:2201.09824 [physics.ins-det].
- [147] A. Tumasyan et al., “Observation of $B^0 \rightarrow \psi(2S) K_S^0 \pi^+ \pi^-$ and $B_S^0 \rightarrow \psi(2S) K_S^0$ decays”, Eur. Phys. J. C **82**, 499 (2022), arXiv:2201.09131 [hep-ex].
- [148] A. Tumasyan et al., “Search for resonances decaying to three W bosons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **129**, 021802 (2022), arXiv:2201.08476 [hep-ex].
- [149] A. Tumasyan et al., “Identification of hadronic tau lepton decays using a deep neural network”, JINST **17**, P07023 (2022), arXiv:2201.08458 [hep-ex].
- [150] A. Tumasyan et al., “Search for charged-lepton flavor violation in top quark production and decay in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **06**, 082 (2022), arXiv:2201.07859 [hep-ex].
- [151] A. Tumasyan et al., “Precision measurement of the W boson decay branching fractions in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **105**, 072008 (2022), arXiv:2201.07861 [hep-ex].
- [152] A. Tumasyan et al., “Measurement of the inclusive and differential $t\bar{t}\gamma$ cross sections in the dilepton channel and effective field theory interpretation in proton-proton collisions at $\sqrt{s}=13$ TeV”, JHEP **05**, 091 (2022), arXiv:2201.07301 [hep-ex].
- [153] A. Tumasyan et al., “Search for long-lived heavy neutral leptons with displaced vertices in proton-proton collisions at $\sqrt{s}=13$ TeV”, JHEP **07**, 081 (2022), arXiv:2201.05578 [hep-ex].
- [154] A. Tumasyan et al., “Search for higgsinos decaying to two Higgs bosons and missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **05**, 014 (2022), arXiv:2201.04206 [hep-ex].
- [155] A. Tumasyan et al., “Observation of the B_c^+ Meson in Pb-Pb and pp Collisions at $\sqrt{s_{NN}}=5.02$ TeV and Measurement of its Nuclear Modification Factor”, Phys. Rev. Lett. **128**, 252301 (2022), arXiv:2201.02659 [hep-ex].
- [156] A. Tumasyan et al., “Search for high-mass resonances decaying to a jet and a Lorentz-boosted resonance in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Lett. B **832**, 137263 (2022), arXiv:2201.02140 [hep-ex].
- [157] A. Tumasyan et al., “Search for single production of a vector-like T quark decaying to a top quark and a Z boson in the final state with jets and missing transverse momentum at $\sqrt{s} = 13$ TeV”, JHEP **05**, 093 (2022), arXiv:2201.02227 [hep-ex].
- [158] A. Tumasyan et al., “Search for long-lived particles decaying into muon pairs in proton-proton collisions at $\sqrt{s} = 13$ TeV collected with a dedicated high-rate data stream”, JHEP **04**, 062 (2022), arXiv:2112.13769 [hep-ex].
- [159] A. Tumasyan et al., “Search for resonances decaying to three W bosons in the hadronic final state in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Rev. D **106**, 012002 (2022), arXiv:2112.13090 [hep-ex].
- [160] A. Tumasyan et al., “Probing Charm Quark Dynamics via Multiparticle Correlations in Pb-Pb Collisions at $\sqrt{s_{NN}}=5.02$ TeV”, Phys. Rev. Lett. **129**, 022001 (2022), arXiv:2112.12236 [hep-ex].
- [161] A. Tumasyan et al., “Search for resonant production of strongly coupled dark matter in proton-proton collisions at 13 TeV”, JHEP **06**, 156 (2022), arXiv:2112.11125 [hep-ex].
- [162] A. Tumasyan et al., “Measurement of the production cross section for Z+b jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **105**, 092014 (2022), arXiv:2112.09659 [hep-ex].
- [163] A. Tumasyan et al., “Search for flavor-changing neutral current interactions of the top quark and the Higgs boson decaying to a bottom quark-antiquark pair at $\sqrt{s} = 13$ TeV”, JHEP **02**, 169 (2022), arXiv:2112.09734 [hep-ex].
- [164] A. Tumasyan et al., “Measurement of the inclusive $t\bar{t}$ production cross section in proton-proton collisions at $\sqrt{s} = 5.02$ TeV”, JHEP **04**, 144 (2022), arXiv:2112.09114 [hep-ex].
- [165] A. Tumasyan et al., “Evidence for WW/WZ vector boson scattering in the decay channel $\ell\nu qq$ produced in association with two jets in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Lett. B **834**, 137438 (2022), arXiv:2112.05259 [hep-ex].
- [166] A. Tumasyan et al., “Search for a right-handed W boson and a heavy neutrino in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **04**, 047 (2022), arXiv:2112.03949 [hep-ex].
- [167] A. Tumasyan et al., “Search for heavy resonances decaying to a pair of Lorentz-boosted Higgs bosons in final states with leptons and a bottom quark pair at $\sqrt{s}=13$ TeV”, JHEP **05**, 005 (2022), arXiv:2112.03161 [hep-ex].

- [168] A. Tumasyan et al., “Measurements of the associated production of a W boson and a charm quark in proton–proton collisions at $\sqrt{s} = 8$ TeV”, *Eur. Phys. J. C* **82**, 1094 (2022), arXiv:2112.00895 [hep-ex].
- [169] A. Tumasyan et al., “Measurement of $W^\pm\gamma$ differential cross sections in proton-proton collisions at $\sqrt{s} = 13$ TeV and effective field theory constraints”, *Phys. Rev. D* **105**, 052003 (2022), arXiv:2111.13948 [hep-ex].
- [170] A. Tumasyan et al., “Search for heavy resonances decaying to ZZ or ZW and axion-like particles mediating nonresonant ZZ or ZH production at $\sqrt{s} = 13$ TeV”, *JHEP* **04**, 087 (2022), arXiv:2111.13669 [hep-ex].
- [171] W. Adam et al., “Selection of the silicon sensor thickness for the Phase-2 upgrade of the CMS Outer Tracker”, *JINST* **16**, P11028 (2021).
- [172] A. Tumasyan et al., “Search for a heavy resonance decaying into a top quark and a W boson in the lepton+jets final state at $\sqrt{s} = 13$ TeV”, *JHEP* **04**, 048 (2022), arXiv:2111.10216 [hep-ex].
- [173] A. Tumasyan et al., “Measurement and QCD analysis of double-differential inclusive jet cross sections in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **02**, [Addendum: *JHEP* 12, 035 (2022)], 142 (2022), arXiv:2111.10431 [hep-ex].
- [174] A. Tumasyan et al., “Strategies and performance of the CMS silicon tracker alignment during LHC Run 2”, *Nucl. Instrum. Meth. A* **1037**, 166795 (2022), arXiv:2111.08757 [physics.ins-det].
- [175] A. Tumasyan et al., “Search for supersymmetry in final states with two or three soft leptons and missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **04**, 091 (2022), arXiv:2111.06296 [hep-ex].
- [176] A. Tumasyan et al., “Observation of triple J/ψ meson production in proton-proton collisions”, *Nature Phys.* **19**, [Erratum: *Nature Phys.* 19, (2023)], 338–350 (2023), arXiv:2111.05370 [hep-ex].
- [177] A. Tumasyan et al., “Study of dijet events with large rapidity separation in proton-proton collisions at $\sqrt{s} = 2.76$ TeV”, *JHEP* **03**, 189 (2022), arXiv:2111.04605 [hep-ex].
- [178] A. Tumasyan et al., “Inclusive and differential cross section measurements of single top quark production in association with a Z boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **02**, 107 (2022), arXiv:2111.02860 [hep-ex].
- [179] A. Tumasyan et al., “A new calibration method for charm jet identification validated with proton-proton collision events at $\sqrt{s} = 13$ TeV”, *JINST* **17**, P03014 (2022), arXiv:2111.03027 [hep-ex].
- [180] A. Tumasyan et al., “Search for Flavor-Changing Neutral Current Interactions of the Top Quark and Higgs Boson in Final States with Two Photons in Proton-Proton Collisions at $\sqrt{s} = 13$ TeV”, *Phys. Rev. Lett.* **129**, 032001 (2022), arXiv:2111.02219 [hep-ex].
- [181] A. Tumasyan et al., “Search for low-mass dilepton resonances in Higgs boson decays to four-lepton final states in proton–proton collisions at $\sqrt{s} = 13$ TeV”, *Eur. Phys. J. C* **82**, 290 (2022), arXiv:2111.01299 [hep-ex].
- [182] A. Tumasyan et al., “Search for long-lived particles produced in association with a Z boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **03**, 160 (2022), arXiv:2110.13218 [hep-ex].
- [183] A. Tumasyan et al., “Measurement of the inclusive and differential WZ production cross sections, polarization angles, and triple gauge couplings in pp collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **07**, 032 (2022), arXiv:2110.11231 [hep-ex].
- [184] A. Tumasyan et al., “First Search for Exclusive Diphoton Production at High Mass with Tagged Protons in Proton-Proton Collisions at $\sqrt{s} = 13$ TeV”, *Phys. Rev. Lett.* **129**, 011801 (2022), arXiv:2110.05916 [hep-ex].
- [185] A. Tumasyan et al., “Analysis of the CP structure of the Yukawa coupling between the Higgs boson and τ leptons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **06**, 012 (2022), arXiv:2110.04836 [hep-ex].
- [186] A. Tumasyan et al., “Search for long-lived particles decaying to leptons with large impact parameter in proton–proton collisions at $\sqrt{s} = 13$ TeV”, *Eur. Phys. J. C* **82**, 153 (2022), arXiv:2110.04809 [hep-ex].
- [187] A. Tumasyan et al., “Measurement of double-parton scattering in inclusive production of four jets with low transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *JHEP* **01**, 177 (2022), arXiv:2109.13822 [hep-ex].
- [188] A. Tumasyan et al., “Search for heavy resonances decaying to $Z(\nu\bar{\nu})V(q\bar{q}')$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Phys. Rev. D* **106**, 012004 (2022), arXiv:2109.08268 [hep-ex].
- [189] A. Tumasyan et al., “Search for heavy resonances decaying to WW, WZ, or WH boson pairs in the lepton plus merged jet final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, *Phys. Rev. D* **105**, 032008 (2022), arXiv:2109.06055 [hep-ex].

- [190] A. Tumasyan et al., “Study of quark and gluon jet substructure in Z+jet and dijet events from pp collisions”, JHEP **01**, 188 (2022), arXiv:2109.03340 [hep-ex].
- [191] A. Tumasyan et al., “Observation of Bs0 mesons and measurement of the Bs0/B+ yield ratio in PbPb collisions at Image 1 TeV”, Phys. Lett. B **829**, 137062 (2022), arXiv:2109.01908 [hep-ex].
- [192] A. Tumasyan et al., “Observation of tW production in the single-lepton channel in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **11**, 111 (2021), arXiv:2109.01706 [hep-ex].
- [193] A. Tumasyan et al., “Measurement of the top quark mass using events with a single reconstructed top quark in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **12**, 161 (2021), arXiv:2108.10407 [hep-ex].
- [194] A. Tumasyan et al., “Measurement of differential $t\bar{t}$ production cross sections in the full kinematic range using lepton+jets events from proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **104**, 092013 (2021), arXiv:2108.02803 [hep-ex].
- [195] K. Lee et al., “Probing effective field theory operators in the associated production of top quarks with a Z boson in multilepton final states at $\sqrt{s} = 13$ TeV”, JHEP **12**, 083 (2021), arXiv:2107.13896 [hep-ex].
- [196] A. Tumasyan et al., “Search for new particles in events with energetic jets and large missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **11**, 153 (2021), arXiv:2107.13021 [hep-ex].
- [197] A. Tumasyan et al., “Search for chargino-neutralino production in events with Higgs and W bosons using 137 fb⁻¹ of proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **10**, 045 (2021), arXiv:2107.12553 [hep-ex].
- [198] A. Tumasyan et al., “Measurement of the inclusive and differential Higgs boson production cross sections in the decay mode to a pair of τ leptons in pp collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **128**, 081805 (2022), arXiv:2107.11486 [hep-ex].
- [199] V. Bertacchi, “Towards a simultaneous measurement of W boson mass and production properties with the CMS detector”, tesi di dott. (Pisa, Scuola Normale Superiore, 2021).
- [200] A. Tumasyan et al., “Combined searches for the production of supersymmetric top quark partners in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **81**, 970 (2021), arXiv:2107.10892 [hep-ex].
- [201] A. Tumasyan et al., “Search for Long-Lived Particles Decaying in the CMS End Cap Muon Detectors in Proton-Proton Collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **127**, 261804 (2021), arXiv:2107.04838 [hep-ex].
- [202] A. Tumasyan et al., “Measurement of prompt open-charm production cross sections in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **11**, 225 (2021), arXiv:2107.01476 [hep-ex].
- [203] A. Tumasyan et al., “Measurement of the inclusive and differential $t\bar{t}\gamma$ cross sections in the single-lepton channel and EFT interpretation at $\sqrt{s} = 13$ TeV”, JHEP **12**, 180 (2021), arXiv:2107.01508 [hep-ex].
- [204] A. Tumasyan et al., “Measurements of the electroweak diboson production cross sections in proton-proton collisions at $\sqrt{s} = 5.02$ TeV using leptonic decays”, Phys. Rev. Lett. **127**, 191801 (2021), arXiv:2107.01137 [hep-ex].
- [205] A. Tumasyan et al., “Search for electroweak production of charginos and neutralinos in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **04**, 147 (2022), arXiv:2106.14246 [hep-ex].
- [206] A. Tumasyan et al., “Fragmentation of jets containing a prompt J/ ψ meson in PbPb and pp collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, Phys. Lett. B **825**, 136842 (2022), arXiv:2106.13235 [hep-ex].
- [207] A. Tumasyan et al., “Measurement of the electroweak production of $Z\gamma$ and two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV and constraints on anomalous quartic gauge couplings”, Phys. Rev. D **104**, 072001 (2021), arXiv:2106.11082 [hep-ex].
- [208] A. Tumasyan et al., “Search for $W\gamma$ resonances in proton-proton collisions at $\sqrt{s} = 13$ TeV using hadronic decays of Lorentz-boosted W bosons”, Phys. Lett. B **826**, 136888 (2022), arXiv:2106.10509 [hep-ex].
- [209] A. Tumasyan et al., “Search for a heavy Higgs boson decaying into two lighter Higgs bosons in the $\tau\tau b\bar{b}$ final state at 13 TeV”, JHEP **11**, 057 (2021), arXiv:2106.10361 [hep-ex].
- [210] A. Tumasyan et al., “Study of Z boson plus jets events using variables sensitive to double-parton scattering in pp collisions at 13 TeV”, JHEP **10**, 176 (2021), arXiv:2105.14511 [hep-ex].
- [211] A. Tumasyan et al., “Measurements of the $pp \rightarrow W^\pm \gamma \gamma$ and $pp \rightarrow Z \gamma \gamma$ cross sections at $\sqrt{s} = 13$ TeV and limits on anomalous quartic gauge couplings”, JHEP **10**, 174 (2021), arXiv:2105.12780 [hep-ex].
- [212] A. Tumasyan et al., “Search for strongly interacting massive particles generating trackless jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **82**, 213 (2022), arXiv:2105.09178 [hep-ex].

- [213] A. M. Sirunyan et al., “Search for lepton-flavor violating decays of the Higgs boson in the $\mu\tau$ and $e\tau$ final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **104**, 032013 (2021), arXiv:2105.03007 [hep-ex].
- [214] W. Adam et al., “Comparative evaluation of analogue front-end designs for the CMS Inner Tracker at the High Luminosity LHC”, JINST **16**, P12014 (2021), arXiv:2105.00070 [physics.ins-det].
- [215] A. M. Sirunyan et al., “Search for long-lived particles decaying to jets with displaced vertices in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **104**, 052011 (2021), arXiv:2104.13474 [hep-ex].
- [216] A. M. Sirunyan et al., “Search for a heavy resonance decaying to a top quark and a W boson at $\sqrt{s} = 13$ TeV in the fully hadronic final state”, JHEP **12**, 106 (2021), arXiv:2104.12853 [hep-ex].
- [217] A. M. Sirunyan et al., “Constraints on anomalous Higgs boson couplings to vector bosons and fermions in its production and decay using the four-lepton final state”, Phys. Rev. D **104**, 052004 (2021), arXiv:2104.12152 [hep-ex].
- [218] A. M. Sirunyan et al., “Search for W’ bosons decaying to a top and a bottom quark at $\sqrt{s}=13$ TeV in the hadronic final state”, Phys. Lett. B **820**, 136535 (2021), arXiv:2104.04831 [hep-ex].
- [219] A. M. Sirunyan et al., “Search for charged Higgs bosons produced in vector boson fusion processes and decaying into vector boson pairs in proton–proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **81**, 723 (2021), arXiv:2104.04762 [hep-ex].
- [220] A. M. Sirunyan et al., “Precision luminosity measurement in proton-proton collisions at $\sqrt{s} = 13$ TeV in 2015 and 2016 at CMS”, Eur. Phys. J. C **81**, 800 (2021), arXiv:2104.01927 [hep-ex].
- [221] A. M. Sirunyan et al., “Constraints on the Initial State of Pb-Pb Collisions via Measurements of Z-Boson Yields and Azimuthal Anisotropy at $\sqrt{s_{NN}}=5.02$ TeV”, Phys. Rev. Lett. **127**, 102002 (2021), arXiv:2103.14089 [hep-ex].
- [222] A. M. Sirunyan et al., “Measurements of Higgs boson production cross sections and couplings in the diphoton decay channel at $\sqrt{s} = 13$ TeV”, JHEP **07**, 027 (2021), arXiv:2103.06956 [hep-ex].
- [223] A. M. Sirunyan et al., “Measurements of production cross sections of the Higgs boson in the four-lepton final state in proton–proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **81**, 488 (2021), arXiv:2103.04956 [hep-ex].
- [224] A. M. Sirunyan et al., “Using Z Boson Events to Study Parton-Medium Interactions in Pb-Pb Collisions”, Phys. Rev. Lett. **128**, 122301 (2022), arXiv:2103.04377 [hep-ex].
- [225] A. M. Sirunyan et al., “Search for resonant and nonresonant new phenomena in high-mass dilepton final states at $\sqrt{s} = 13$ TeV”, JHEP **07**, 208 (2021), arXiv:2103.02708 [hep-ex].
- [226] A. M. Sirunyan et al., “Search for top squark production in fully-hadronic final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **104**, 052001 (2021), arXiv:2103.01290 [hep-ex].
- [227] A. M. Sirunyan et al., “Study of Drell-Yan dimuon production in proton-lead collisions at $\sqrt{s_{NN}} = 8.16$ TeV”, JHEP **05**, 182 (2021), arXiv:2102.13648 [hep-ex].
- [228] A. M. Sirunyan et al., “Evidence for X(3872) in Pb-Pb Collisions and Studies of its Prompt Production at $\sqrt{s_{NN}}=5.02$ TeV”, Phys. Rev. Lett. **128**, 032001 (2022), arXiv:2102.13048 [hep-ex].
- [229] A. M. Sirunyan et al., “First measurement of large area jet transverse momentum spectra in heavy-ion collisions”, JHEP **05**, 284 (2021), arXiv:2102.13080 [hep-ex].
- [230] A. M. Sirunyan et al., “Measurements of angular distance and momentum ratio distributions in three-jet and Z + two-jet final states in pp collisions”, Eur. Phys. J. C **81**, 852 (2021), arXiv:2102.08816 [hep-ex].
- [231] A. M. Sirunyan et al., “Search for a heavy vector resonance decaying to a Z boson and a Higgs boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **81**, 688 (2021), arXiv:2102.08198 [hep-ex].
- [232] A. M. Sirunyan et al., “Hard color-singlet exchange in dijet events in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **104**, 032009 (2021), arXiv:2102.06945 [hep-ex].
- [233] A. M. Sirunyan et al., “Search for top squarks in final states with two top quarks and several light-flavor jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **104**, 032006 (2021), arXiv:2102.06976 [hep-ex].
- [234] A. M. Sirunyan et al., “Performance of the CMS muon trigger system in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JINST **16**, P07001 (2021), arXiv:2102.04790 [hep-ex].
- [235] A. M. Sirunyan et al., “Observation of a New Excited Beauty Strange Baryon Decaying to $\Xi_b^- \pi^+ \pi^-$ ”, Phys. Rev. Lett. **126**, 252003 (2021), arXiv:2102.04524 [hep-ex].

- [236] A. M. Sirunyan et al., “Measurements of the differential cross sections of the production of $Z + \text{jets}$ and $\gamma + \text{jets}$ and of Z boson emission collinear with a jet in pp collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, JHEP **05**, 285 (2021), arXiv:2102.02238 [hep-ex].
- [237] A. M. Sirunyan et al., “Measurement of the $W\gamma$ Production Cross Section in Proton-Proton Collisions at $\sqrt{s}=13 \text{ TeV}$ and Constraints on Effective Field Theory Coefficients”, Phys. Rev. Lett. **126**, 252002 (2021), arXiv:2102.02283 [hep-ex].
- [238] A. M. Sirunyan et al., “In-medium modification of dijets in PbPb collisions at $\sqrt{s_{NN}} = 5.02 \text{ TeV}$ ”, JHEP **05**, 116 (2021), arXiv:2101.04720 [hep-ex].
- [239] W. Adam et al., “The CMS Phase-1 Pixel Detector Upgrade”, JINST **16**, P02027 (2021), arXiv:2012.14304 [physics.ins-det].
- [240] A. M. Sirunyan et al., “First measurement of the cross section for top quark pair production with additional charm jets using dileptonic final states in pp collisions at $s=13\text{TeV}$ ”, Phys. Lett. B **820**, 136565 (2021), arXiv:2012.09225 [hep-ex].
- [241] A. M. Sirunyan et al., “Measurement of the Z boson differential production cross section using its invisible decay mode ($Z\nu\bar{\nu}$) in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, JHEP **05**, 205 (2021), arXiv:2012.09254 [hep-ex].
- [242] A. M. Sirunyan et al., “Search for supersymmetry in final states with two oppositely charged same-flavor leptons and missing transverse momentum in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, JHEP **04**, 123 (2021), arXiv:2012.08600 [hep-ex].
- [243] A. M. Sirunyan et al., “Electron and photon reconstruction and identification with the CMS experiment at the CERN LHC”, JINST **16**, P05014 (2021), arXiv:2012.06888 [hep-ex].
- [244] A. M. Sirunyan et al., “Measurement of differential cross sections for Z bosons produced in association with charm jets in pp collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, JHEP **04**, 109 (2021), arXiv:2012.04119 [hep-ex].
- [245] A. M. Sirunyan et al., “Search for singly and pair-produced leptoquarks coupling to third-generation fermions in proton-proton collisions at $s=13 \text{ TeV}$ ”, Phys. Lett. B **819**, 136446 (2021), arXiv:2012.04178 [hep-ex].
- [246] T. C. Collaboration et al., “Search for new physics in top quark production with additional leptons in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ using effective field theory”, JHEP **03**, 095 (2021), arXiv:2012.04120 [hep-ex].
- [247] A. M. Sirunyan et al., “Search for long-lived particles using displaced jets in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, Phys. Rev. D **104**, 012015 (2021), arXiv:2012.01581 [hep-ex].
- [248] A. M. Sirunyan et al., “Search for nonresonant Higgs boson pair production in final states with two bottom quarks and two photons in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, JHEP **03**, 257 (2021), arXiv:2011.12373 [hep-ex].
- [249] A. M. Sirunyan et al., “Search for the rare decay of the W boson into a pion and a photon in proton-proton collisions at $s=13\text{TeV}$ ”, Phys. Lett. B **819**, 136409 (2021), arXiv:2011.06028 [hep-ex].
- [250] A. M. Sirunyan et al., “Observation of Forward Neutron Multiplicity Dependence of Dimuon Acoplanarity in Ultraperipheral Pb-Pb Collisions at $\sqrt{s_{NN}}=5.02 \text{ TeV}$ ”, Phys. Rev. Lett. **127**, 122001 (2021), arXiv:2011.05239 [hep-ex].
- [251] A. M. Sirunyan et al., “Development and validation of HERWIG 7 tunes from CMS underlying-event measurements”, Eur. Phys. J. C **81**, 312 (2021), arXiv:2011.03422 [hep-ex].
- [252] A. M. Sirunyan et al., “Measurement of the Higgs boson production rate in association with top quarks in final states with electrons, muons, and hadronically decaying tau leptons at $\sqrt{s} = 13 \text{ TeV}$ ”, Eur. Phys. J. C **81**, 378 (2021), arXiv:2011.03652 [hep-ex].
- [253] V. Khachatryan et al., “The very forward CASTOR calorimeter of the CMS experiment”, JINST **16**, P02010 (2021), arXiv:2011.01185 [physics.ins-det].
- [254] A. M. Sirunyan et al., “Angular analysis of the decay $B^+ \rightarrow K^*(892)^+\mu^+\mu^-$ in proton-proton collisions at $\sqrt{s} = 8 \text{ TeV}$ ”, JHEP **04**, 124 (2021), arXiv:2010.13968 [hep-ex].
- [255] A. M. Sirunyan et al., “MUSiC: a model-unspecific search for new physics in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, Eur. Phys. J. C **81**, 629 (2021), arXiv:2010.02984 [hep-ex].
- [256] A. M. Sirunyan et al., “Search for dark photons in Higgs boson production via vector boson fusion in proton-proton collisions at $\sqrt{s} = 13 \text{ TeV}$ ”, JHEP **03**, 011 (2021), arXiv:2009.14009 [hep-ex].
- [257] A. M. Sirunyan et al., “Measurement of prompt D^0 and \bar{D}^0 meson azimuthal anisotropy and search for strong electric fields in PbPb collisions at $\sqrt{s_{NN}} = 5.02 \text{ TeV}$ ”, Phys. Lett. B **816**, 136253 (2021), arXiv:2009.12628 [hep-ex].

- [258] A. M. Sirunyan et al., “Measurements of production cross sections of polarized same-sign W boson pairs in association with two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **812**, 136018 (2021), arXiv:2009.09429 [hep-ex].
- [259] A. M. Sirunyan et al., “Studies of charm and beauty hadron long-range correlations in pp and pPb collisions at LHC energies”, Phys. Lett. B **813**, 136036 (2021), arXiv:2009.07065 [hep-ex].
- [260] A. M. Sirunyan et al., “Measurement of the top quark Yukawa coupling from $t\bar{t}$ kinematic distributions in the dilepton final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **102**, 092013 (2020), arXiv:2009.07123 [hep-ex].
- [261] A. M. Sirunyan et al., “Evidence for Higgs boson decay to a pair of muons”, JHEP **01**, 148 (2021), arXiv:2009.04363 [hep-ex].
- [262] A. M. Sirunyan et al., “Measurements of $pp \rightarrow ZZ$ production cross sections and constraints on anomalous triple gauge couplings at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **81**, 200 (2021), arXiv:2009.01186 [hep-ex].
- [263] A. M. Sirunyan et al., “ W^+W^- boson pair production in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **102**, 092001 (2020), arXiv:2009.00119 [hep-ex].
- [264] A. M. Sirunyan et al., “Observation of electroweak production of $W\gamma$ with two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **811**, 135988 (2020), arXiv:2008.10521 [hep-ex].
- [265] A. M. Sirunyan et al., “A search for bottom-type, vector-like quark pair production in a fully hadronic final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **102**, 112004 (2020), arXiv:2008.09835 [hep-ex].
- [266] A. M. Sirunyan et al., “Measurement of $B_c(2S)^+$ and $B_c^*(2S)^+$ cross section ratios in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **102**, 092007 (2020), arXiv:2008.08629 [hep-ex].
- [267] A. M. Sirunyan et al., “Measurement of differential $t\bar{t}$ production cross sections using top quarks at large transverse momenta in pp collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **103**, 052008 (2021), arXiv:2008.07860 [hep-ex].
- [268] A. M. Sirunyan et al., “Evidence for electroweak production of four charged leptons and two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **812**, 135992 (2021), arXiv:2008.07013 [hep-ex].
- [269] A. M. Sirunyan et al., “Search for top squark pair production using dilepton final states in pp collision data collected at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **81**, 3 (2021), arXiv:2008.05936 [hep-ex].
- [270] A. M. Sirunyan et al., “Search for dark matter produced in association with a leptonically decaying Z boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **81**, [Erratum: Eur.Phys.J.C 81, 333 (2021)], 13 (2021), arXiv:2008.04735 [hep-ex].
- [271] A. M. Sirunyan et al., “Measurements of the W boson rapidity, helicity, double-differential cross sections, and charge asymmetry in pp collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **102**, 092012 (2020), arXiv:2008.04174 [hep-ex].
- [272] A. M. Sirunyan et al., “Search for supersymmetry in proton-proton collisions at $\sqrt{s} = 13$ TeV in events with high-momentum Z bosons and missing transverse momentum”, JHEP **09**, 149 (2020), arXiv:2008.04422 [hep-ex].
- [273] A. M. Sirunyan et al., “Search for decays of the 125 GeV Higgs boson into a Z boson and a ρ or ϕ meson”, JHEP **11**, 039 (2020), arXiv:2007.05122 [hep-ex].
- [274] A. M. Sirunyan et al., “Search for the lepton flavor violating decay $\tau \rightarrow 3\mu$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **01**, 163 (2021), arXiv:2007.05658 [hep-ex].
- [275] A. M. Sirunyan et al., “Investigation into the event-activity dependence of $\Upsilon(nS)$ relative production in proton-proton collisions at $\sqrt{s} = 7$ TeV”, JHEP **11**, 001 (2020), arXiv:2007.04277 [hep-ex].
- [276] A. M. Sirunyan et al., “Measurement of the CP -violating phase ϕ_s in the $B_s^0 \rightarrow J/\psi \phi(1020) \rightarrow \mu^+\mu^-K^+K^-$ channel in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **816**, 136188 (2021), arXiv:2007.02434 [hep-ex].
- [277] A. M. Sirunyan et al., “Measurement of the inclusive and differential Higgs boson production cross sections in the leptonic WW decay mode at $\sqrt{s} = 13$ TeV”, JHEP **03**, 003 (2021), arXiv:2007.01984 [hep-ex].
- [278] A. M. Sirunyan et al., “Reconstruction of signal amplitudes in the CMS electromagnetic calorimeter in the presence of overlapping proton-proton interactions”, JINST **15**, P10002 (2020), arXiv:2006.14359 [physics.ins-det].
- [279] A. M. Sirunyan et al., “Inclusive search for highly boosted Higgs bosons decaying to bottom quark-antiquark pairs in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **12**, 085 (2020), arXiv:2006.13251 [hep-ex].
- [280] A. M. Sirunyan et al., “Evidence for Top Quark Production in Nucleus-Nucleus Collisions”, Phys. Rev. Lett. **125**, 222001 (2020), arXiv:2006.11110 [hep-ex].

- [281] A. M. Sirunyan et al., “Observation of the Production of Three Massive Gauge Bosons at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **125**, 151802 (2020), arXiv:2006.11191 [hep-ex].
- [282] A. M. Sirunyan et al., “Performance of the CMS Level-1 trigger in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JINST **15**, P10017 (2020), arXiv:2006.10165 [hep-ex].
- [283] A. M. Sirunyan et al., “Measurement of the azimuthal anisotropy of Image 1 and Image 2 mesons in PbPb collisions at sNN=5.02TeV”, Phys. Lett. B **819**, 136385 (2021), arXiv:2006.07707 [hep-ex].
- [284] A. M. Sirunyan et al., “Search for resonant pair production of Higgs bosons in the $bbZZ$ channel in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **102**, 032003 (2020), arXiv:2006.06391 [hep-ex].
- [285] A. M. Sirunyan et al., “Measurement of b jet shapes in proton-proton collisions at $\sqrt{s} = 5.02$ TeV”, JHEP **05**, 054 (2021), arXiv:2005.14219 [hep-ex].
- [286] A. M. Sirunyan et al., “Search for a light charged Higgs boson in the $H^\pm \rightarrow cs$ channel in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **102**, 072001 (2020), arXiv:2005.08900 [hep-ex].
- [287] A. M. Sirunyan et al., “Search for a light pseudoscalar Higgs boson in the boosted $\mu\mu\tau\tau$ final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **08**, 139 (2020), arXiv:2005.08694 [hep-ex].
- [288] A. M. Sirunyan et al., “Dependence of inclusive jet production on the anti- k_T distance parameter in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **12**, 082 (2020), arXiv:2005.05159 [hep-ex].
- [289] A. M. Sirunyan et al., “Observation of the $B_s^0 \rightarrow X(3872)\phi$ decay”, Phys. Rev. Lett. **125**, 152001 (2020), arXiv:2005.04764 [hep-ex].
- [290] G. Aad et al., “Combination of the W boson polarization measurements in top quark decays using ATLAS and CMS data at $\sqrt{s} = 8$ TeV”, JHEP **08**, 051 (2020), arXiv:2005.03799 [hep-ex].
- [291] A. M. Sirunyan et al., “Measurements of production cross sections of WZ and same-sign WW boson pairs in association with two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **809**, 135710 (2020), arXiv:2005.01173 [hep-ex].
- [292] A. M. Sirunyan et al., “Measurement of CKM matrix elements in single top quark t -channel production in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **808**, 135609 (2020), arXiv:2004.12181 [hep-ex].
- [293] A. M. Sirunyan et al., “Identification of heavy, energetic, hadronically decaying particles using machine-learning techniques”, JINST **15**, P06005 (2020), arXiv:2004.08262 [hep-ex].
- [294] A. M. Sirunyan et al., “Search for disappearing tracks in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **806**, 135502 (2020), arXiv:2004.05153 [hep-ex].
- [295] R. Thalmeier et al., “Series production testing and commissioning of the Belle II SVD readout system”, Nucl. Instrum. Meth. A **958**, a cura di M. Krammer et al., 162942 (2020).
- [296] G. Casarosa et al., “Commissioning of the Belle II Silicon Vertex Detector”, Nucl. Instrum. Meth. A **958**, a cura di M. Krammer et al., 162184 (2020).
- [297] C. Irmeler et al., “Run and slow control system of the Belle II silicon vertex detector”, Nucl. Instrum. Meth. A **958**, a cura di M. Krammer et al., 162706 (2020).
- [298] A. M. Sirunyan et al., “Measurement of quark- and gluon-like jet fractions using jet charge in PbPb and pp collisions at 5.02 TeV”, JHEP **07**, 115 (2020), arXiv:2004.00602 [hep-ex].
- [299] A. M. Sirunyan et al., “The production of isolated photons in PbPb and pp collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, JHEP **07**, 116 (2020), arXiv:2003.12797 [hep-ex].
- [300] V. Bertacchi et al., “Track finding at Belle II”, Comput. Phys. Commun. **259**, 107610 (2021), arXiv:2003.12466 [physics.ins-det].
- [301] A. M. Sirunyan et al., “Search for supersymmetry in pp collisions at $\sqrt{s} = 13$ TeV with 137 fb^{-1} in final states with a single lepton using the sum of masses of large-radius jets”, Phys. Rev. D **101**, 052010 (2020), arXiv:1911.07558 [hep-ex].
- [302] A. M. Sirunyan et al., “Measurements of $t\bar{t}H$ Production and the CP Structure of the Yukawa Interaction between the Higgs Boson and Top Quark in the Diphoton Decay Channel”, Phys. Rev. Lett. **125**, 061801 (2020), arXiv:2003.10866 [hep-ex].
- [303] W. Adam et al., “Beam test performance of prototype silicon detectors for the Outer Tracker for the Phase-2 Upgrade of CMS”, JINST **15**, P03014 (2020).

- [304] A. M. Sirunyan et al., “Measurement of the cross section for $t\bar{t}$ production with additional jets and b jets in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 125 (2020), arXiv:2003.06467 [hep-ex].
- [305] A. M. Sirunyan et al., “Study of central exclusive $\pi^+\pi^-$ production in proton-proton collisions at $\sqrt{s} = 5.02$ and 13 TeV”, Eur. Phys. J. C **80**, 718 (2020), arXiv:2003.02811 [hep-ex].
- [306] A. M. Sirunyan et al., “Pileup mitigation at CMS in 13 TeV data”, JINST **15**, P09018 (2020), arXiv:2003.00503 [hep-ex].
- [307] V. Bertacchi et al., “Impact of the PDFs on the Z and W lineshapes at LHC”, Nuovo Cim. C **43**, a cura di G. D’Ambrosio et al., 28 (2020).
- [308] A. M. Sirunyan et al., “Measurement of the cross section for electroweak production of a Z boson, a photon and two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV and constraints on anomalous quartic couplings”, JHEP **06**, 076 (2020), arXiv:2002.09902 [hep-ex].
- [309] A. M. Sirunyan et al., “Measurement of the $\Upsilon(1S)$ pair production cross section and search for resonances decaying to $\Upsilon(1S)\mu^+\mu^-$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **808**, 135578 (2020), arXiv:2002.06393 [hep-ex].
- [310] A. M. Sirunyan et al., “A measurement of the Higgs boson mass in the diphoton decay channel”, Phys. Lett. B **805**, 135425 (2020), arXiv:2002.06398 [hep-ex].
- [311] A. M. Sirunyan et al., “Search for physics beyond the standard model in events with jets and two same-sign or at least three charged leptons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **80**, 752 (2020), arXiv:2001.10086 [hep-ex].
- [312] A. M. Sirunyan et al., “Search for charged Higgs bosons decaying into a top and a bottom quark in the all-jet final state of pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **07**, 126 (2020), arXiv:2001.07763 [hep-ex].
- [313] A. M. Sirunyan et al., “Measurement of the associated production of a Z boson with charm or bottom quark jets in proton-proton collisions at $\sqrt{s}=13$ TeV”, Phys. Rev. D **102**, 032007 (2020), arXiv:2001.06899 [hep-ex].
- [314] A. M. Sirunyan et al., “Study of excited Λ_b^0 states decaying to $\Lambda_b^0\pi^+\pi^-$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **803**, 135345 (2020), arXiv:2001.06533 [hep-ex].
- [315] A. M. Sirunyan et al., “Measurements with silicon photomultipliers of dose-rate effects in the radiation damage of plastic scintillator tiles in the CMS hadron endcap calorimeter”, JINST **15**, P06009 (2020), arXiv:2001.06553 [physics.ins-det].
- [316] A. M. Sirunyan et al., “Search for an excited lepton that decays via a contact interaction to a lepton and two jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **05**, 052 (2020), arXiv:2001.04521 [hep-ex].
- [317] G. Steinbruck et al., “Experimental Study of Different Silicon Sensor Options for the Upgrade of the CMS Outer Tracker”, JINST **15**, P04017 (2020), arXiv:2001.02023 [physics.ins-det].
- [318] A. M. Sirunyan et al., “A deep neural network to search for new long-lived particles decaying to jets”, Mach. Learn. Sci. Tech. **1**, 035012 (2020), arXiv:1912.12238 [hep-ex].
- [319] A. M. Sirunyan et al., “Measurement of the top quark forward-backward production asymmetry and the anomalous chromoelectric and chromomagnetic moments in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **06**, 146 (2020), arXiv:1912.09540 [hep-ex].
- [320] A. M. Sirunyan et al., “Search for direct top squark pair production in events with one lepton, jets, and missing transverse momentum at 13 TeV with the CMS experiment”, JHEP **05**, 032 (2020), arXiv:1912.08887 [hep-ex].
- [321] A. M. Sirunyan et al., “Constraints on the χ_{c1} versus χ_{c2} Polarizations in Proton-Proton Collisions at $\sqrt{s} = 8$ TeV”, Phys. Rev. Lett. **124**, 162002 (2020), arXiv:1912.07706 [hep-ex].
- [322] A. M. Sirunyan et al., “A Deep Neural Network for Simultaneous Estimation of b Jet Energy and Resolution”, Comput. Softw. Big Sci. **4**, 10 (2020), arXiv:1912.06046 [physics.data-an].
- [323] A. M. Sirunyan et al., “Search for a Narrow Resonance Lighter than 200 GeV Decaying to a Pair of Muons in Proton-Proton Collisions at $\sqrt{s} = \text{TeV}$ ”, Phys. Rev. Lett. **124**, 131802 (2020), arXiv:1912.04776 [hep-ex].
- [324] A. M. Sirunyan et al., “Determination of the strong coupling constant $\alpha_S(m_Z)$ from measurements of inclusive W^\pm and Z boson production cross sections in proton-proton collisions at $\sqrt{s} = 7$ and 8 TeV”, JHEP **06**, 018 (2020), arXiv:1912.04387 [hep-ex].
- [325] A. M. Sirunyan et al., “Performance of the reconstruction and identification of high-momentum muons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JINST **15**, P02027 (2020), arXiv:1912.03516 [physics.ins-det].

- [326] A. M. Sirunyan et al., “Search for a heavy Higgs boson decaying to a pair of W bosons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **03**, 034 (2020), arXiv:1912.01594 [hep-ex].
- [327] A. M. Sirunyan et al., “A search for the standard model Higgs boson decaying to charm quarks”, JHEP **03**, 131 (2020), arXiv:1912.01662 [hep-ex].
- [328] A. M. Sirunyan et al., “Measurement of the top quark pair production cross section in dilepton final states containing one τ lepton in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **02**, 191 (2020), arXiv:1911.13204 [hep-ex].
- [329] A. M. Sirunyan et al., “Search for lepton flavour violating decays of a neutral heavy Higgs boson to $\mu\tau$ and $e\tau$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **03**, 103 (2020), arXiv:1911.10267 [hep-ex].
- [330] A. M. Sirunyan et al., “Search for physics beyond the standard model in multilepton final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **03**, 051 (2020), arXiv:1911.04968 [hep-ex].
- [331] A. M. Sirunyan et al., “Search for high mass dijet resonances with a new background prediction method in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **05**, 033 (2020), arXiv:1911.03947 [hep-ex].
- [332] A. M. Sirunyan et al., “Measurement of the Jet Mass Distribution and Top Quark Mass in Hadronic Decays of Boosted Top Quarks in pp Collisions at $\sqrt{s} = \text{TeV}$ ”, Phys. Rev. Lett. **124**, 202001 (2020), arXiv:1911.03800 [hep-ex].
- [333] A. M. Sirunyan et al., “Observation of the $\Lambda_b^0 \rightarrow J/\psi \Lambda \phi$ decay in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **802**, 135203 (2020), arXiv:1911.03789 [hep-ex].
- [334] A. M. Sirunyan et al., “Search for new neutral Higgs bosons through the $H \rightarrow ZA \rightarrow \ell^+ \ell^- b\bar{b}$ process in pp collisions at $\sqrt{s} = 13$ TeV”, JHEP **03**, 055 (2020), arXiv:1911.03781 [hep-ex].
- [335] A. M. Sirunyan et al., “Search for dijet resonances using events with three jets in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **805**, 135448 (2020), arXiv:1911.03761 [hep-ex].
- [336] A. M. Sirunyan et al., “Search for top squark pair production in a final state with two tau leptons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **02**, 015 (2020), arXiv:1910.12932 [hep-ex].
- [337] A. M. Sirunyan et al., “Measurement of properties of $B_s^0 \rightarrow \mu^+ \mu^-$ decays and search for $B^0 \rightarrow \mu^+ \mu^-$ with the CMS experiment”, JHEP **04**, 188 (2020), arXiv:1910.12127 [hep-ex].
- [338] A. M. Sirunyan et al., “Search for a heavy pseudoscalar Higgs boson decaying into a 125 GeV Higgs boson and a Z boson in final states with two tau and two light leptons at $\sqrt{s} = 13$ TeV”, JHEP **03**, 065 (2020), arXiv:1910.11634 [hep-ex].
- [339] A. M. Sirunyan et al., “Mixed higher-order anisotropic flow and nonlinear response coefficients of charged particles in PbPb collisions at $\sqrt{s_{NN}} = 2.76$ and 5.02 TeV”, Eur. Phys. J. C **80**, 534 (2020), arXiv:1910.08789 [hep-ex].
- [340] V. Bertacchi, “DeepCore: Convolutional Neural Network for high p_T jet tracking”, in Connecting the Dots and Workshop on Intelligent Trackers (oct. 2019), arXiv:1910.08058 [physics.ins-det].
- [341] W. Adam et al., “The DAQ and control system for the CMS Phase-1 pixel detector upgrade”, JINST **14**, P10017 (2019).
- [342] A. M. Sirunyan et al., “Study of J/ψ meson production inside jets in pp collisions at $\sqrt{s} = 8$ TeV”, Phys. Lett. B **804**, 135409 (2020), arXiv:1910.01686 [hep-ex].
- [343] A. M. Sirunyan et al., “Search for Supersymmetry with a Compressed Mass Spectrum in Events with a Soft τ Lepton, a Highly Energetic Jet, and Large Missing Transverse Momentum in Proton-Proton Collisions at $\sqrt{s} = \text{TeV}$ ”, Phys. Rev. Lett. **124**, 041803 (2020), arXiv:1910.01185 [hep-ex].
- [344] A. M. Sirunyan et al., “Calibration of the CMS hadron calorimeters using proton-proton collision data at $\sqrt{s} = 13$ TeV”, JINST **15**, P05002 (2020), arXiv:1910.00079 [physics.ins-det].
- [345] A. M. Sirunyan et al., “Running of the top quark mass from proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **803**, 135263 (2020), arXiv:1909.09193 [hep-ex].
- [346] V. Bertacchi et al., “Impact of the PDFs on the Z and W lineshapes at LHC”, Eur. Phys. J. C **80**, 328 (2020), arXiv:1909.07935 [hep-ex].
- [347] A. M. Sirunyan et al., “Evidence for WW production from double-parton interactions in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **80**, 41 (2020), arXiv:1909.06265 [hep-ex].
- [348] A. M. Sirunyan et al., “Search for long-lived particles using delayed photons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **100**, 112003 (2019), arXiv:1909.06166 [hep-ex].

- [349] A. M. Sirunyan et al., “Measurement of the $t\bar{t}b\bar{b}$ production cross section in the all-jet final state in pp collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **803**, 135285 (2020), arXiv:1909.05306 [hep-ex].
- [350] A. M. Sirunyan et al., “Search for electroweak production of a vector-like T quark using fully hadronic final states”, JHEP **01**, 036 (2020), arXiv:1909.04721 [hep-ex].
- [351] A. M. Sirunyan et al., “Search for low mass vector resonances decaying into quark-antiquark pairs in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **100**, 112007 (2019), arXiv:1909.04114 [hep-ex].
- [352] A. M. Sirunyan et al., “Measurements of differential Z boson production cross sections in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **12**, 061 (2019), arXiv:1909.04133 [hep-ex].
- [353] A. M. Sirunyan et al., “Searches for physics beyond the standard model with the M_{T2} variable in hadronic final states with and without disappearing tracks in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **80**, 3 (2020), arXiv:1909.03460 [hep-ex].
- [354] A. M. Sirunyan et al., “Search for a charged Higgs boson decaying into top and bottom quarks in events with electrons or muons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **01**, 096 (2020), arXiv:1908.09206 [hep-ex].
- [355] A. M. Sirunyan et al., “Search for supersymmetry using Higgs boson to diphoton decays at $\sqrt{s} = 13$ TeV”, JHEP **11**, 109 (2019), arXiv:1908.08500 [hep-ex].
- [356] P. Kodyš et al., “The Belle II vertex detector integration”, Nucl. Instrum. Meth. A **936**, a cura di G. Batignani et al., 616–620 (2019).
- [357] R. Thalmeier et al., “The Belle II silicon vertex detector: Assembly and initial results”, Nucl. Instrum. Meth. A **936**, a cura di G. Batignani et al., 712–714 (2019).
- [358] A. M. Sirunyan et al., “Search for production of four top quarks in final states with same-sign or multiple leptons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **80**, 75 (2020), arXiv:1908.06463 [hep-ex].
- [359] T. C. Collaboration et al., “Search for supersymmetry in proton-proton collisions at 13 TeV in final states with jets and missing transverse momentum”, JHEP **10**, 244 (2019), arXiv:1908.04722 [hep-ex].
- [360] B. Schwenker et al., “Operational experience and commissioning of the Belle II vertex detector”, PoS **VERTX2018**, 006 (2019).
- [361] A. M. Sirunyan et al., “Search for dark photons in decays of Higgs bosons produced in association with Z bosons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **10**, 139 (2019), arXiv:1908.02699 [hep-ex].
- [362] A. M. Sirunyan et al., “Measurement of the average very forward energy as a function of the track multiplicity at central pseudorapidities in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **79**, 893 (2019), arXiv:1908.01750 [hep-ex].
- [363] A. M. Sirunyan et al., “Search for dark matter particles produced in association with a Higgs boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **03**, 025 (2020), arXiv:1908.01713 [hep-ex].
- [364] A. M. Sirunyan et al., “Search for heavy Higgs bosons decaying to a top quark pair in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **04**, [Erratum: JHEP 03, 187 (2022)], 171 (2020), arXiv:1908.01115 [hep-ex].
- [365] A. M. Sirunyan et al., “Search for direct pair production of supersymmetric partners to the τ lepton in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **80**, 189 (2020), arXiv:1907.13179 [hep-ex].
- [366] A. M. Sirunyan et al., “Measurement of top quark pair production in association with a Z boson in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **03**, 056 (2020), arXiv:1907.11270 [hep-ex].
- [367] A. M. Sirunyan et al., “Measurement of differential cross sections and charge ratios for t-channel single top quark production in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Eur. Phys. J. C **80**, 370 (2020), arXiv:1907.08330 [hep-ex].
- [368] A. M. Sirunyan et al., “Search for anomalous triple gauge couplings in WW and WZ production in lepton + jet events in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **12**, 062 (2019), arXiv:1907.08354 [hep-ex].
- [369] A. M. Sirunyan et al., “Search for Physics beyond the Standard Model in Events with Overlapping Photons and Jets”, Phys. Rev. Lett. **123**, 241801 (2019), arXiv:1907.06275 [hep-ex].
- [370] A. M. Sirunyan et al., “Study of the $B^+ \rightarrow J/\psi \bar{\Lambda} p$ decay in proton-proton collisions at $\sqrt{s} = 8$ TeV”, JHEP **12**, 100 (2019), arXiv:1907.05461 [hep-ex].
- [371] A. M. Sirunyan et al., “Search for MSSM Higgs bosons decaying to $\mu + \mu -$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **798**, 134992 (2019), arXiv:1907.03152 [hep-ex].

- [372] A. M. Sirunyan et al., “Measurement of the top quark Yukawa coupling from $t\bar{t}$ kinematic distributions in the lepton+jets final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **100**, 072007 (2019), arXiv:1907.01590 [hep-ex].
- [373] A. M. Sirunyan et al., “Combined search for supersymmetry with photons in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **801**, 135183 (2020), arXiv:1907.00857 [hep-ex].
- [374] A. M. Sirunyan et al., “Search for pair production of vectorlike quarks in the fully hadronic final state”, Phys. Rev. D **100**, 072001 (2019), arXiv:1906.11903 [hep-ex].
- [375] A. M. Sirunyan et al., “Search for long-lived particles using nonprompt jets and missing transverse momentum with proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **797**, 134876 (2019), arXiv:1906.06441 [hep-ex].
- [376] A. M. Sirunyan et al., “A multi-dimensional search for new heavy resonances decaying to boosted WW, WZ, or ZZ boson pairs in the dijet final state at 13 TeV”, Eur. Phys. J. C **80**, 237 (2020), arXiv:1906.05977 [hep-ex].
- [377] A. M. Sirunyan et al., “Production of Λ_c^+ baryons in proton-proton and lead-lead collisions at $\sqrt{s_{NN}} = 5.02$ TeV”, Phys. Lett. B **803**, 135328 (2020), arXiv:1906.03322 [hep-ex].
- [378] A. M. Sirunyan et al., “Search for the production of four top quarks in the single-lepton and opposite-sign dilepton final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **11**, 082 (2019), arXiv:1906.02805 [hep-ex].
- [379] A. M. Sirunyan et al., “Combination of CMS searches for heavy resonances decaying to pairs of bosons or leptons”, Phys. Lett. B **798**, 134952 (2019), arXiv:1906.00057 [hep-ex].
- [380] A. M. Sirunyan et al., “Search for vector-like leptons in multilepton final states in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **100**, 052003 (2019), arXiv:1905.10853 [hep-ex].
- [381] A. M. Sirunyan et al., “Search for Low-Mass Quark-Antiquark Resonances Produced in Association with a Photon at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **123**, 231803 (2019), arXiv:1905.10331 [hep-ex].
- [382] A. M. Sirunyan et al., “Search for Higgs and Z boson decays to J/ψ or Y pairs in the four-muon final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **797**, 134811 (2019), arXiv:1905.10408 [hep-ex].
- [383] R. Thalmeier et al., “Machine learning: hit time finding with a neural network”, PoS **TWEPP2018**, 065 (2019).
- [384] A. M. Sirunyan et al., “Search for a light charged Higgs boson decaying to a W boson and a CP-odd Higgs boson in final states with $e\mu\mu$ or $\mu\mu\mu$ in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **123**, 131802 (2019), arXiv:1905.07453 [hep-ex].
- [385] A. M. Sirunyan et al., “Search for the production of $W^\pm W^\pm W^\mp$ events at $\sqrt{s} = 13$ TeV”, Phys. Rev. D **100**, 012004 (2019), arXiv:1905.04246 [hep-ex].
- [386] A. M. Sirunyan et al., “Search for resonances decaying to a pair of Higgs bosons in the $b\bar{b}q\bar{q}'\ell\nu$ final state in proton-proton collisions at $\sqrt{s} = 13$ TeV”, JHEP **10**, 125 (2019), arXiv:1904.04193 [hep-ex].
- [387] K. Lalwani et al., “Performance Studies of the Belle II Silicon Vertex Detector”, PoS **VERTEX2018**, 052 (2019).
- [388] S. Halder et al., “Spatial Resolution of the Belle II Silicon Vertex Detector”, PoS **VERTEX2018**, 054 (2019).
- [389] H. Aihara et al., “The Silicon Vertex Detector of the Belle II Experiment”, PoS **VERTEX2018**, 024 (2019).
- [390] A. M. Sirunyan et al., “Observation of Two Excited B_c^+ States and Measurement of the $B_c^+(2S)$ Mass in pp Collisions at $\sqrt{s} = 13$ TeV”, Phys. Rev. Lett. **122**, 132001 (2019), arXiv:1902.00571 [hep-ex].
- [391] P. K. Resmi et al., “Construction and quality assurance of the Belle II Silicon Vertex Detector”, PoS **VERTEX2018**, 051 (2019), arXiv:1901.09549 [physics.ins-det].
- [392] K. Lalwani et al., “Performance of the Belle II SVD”, Springer Proc. Phys. **234**, a cura di A. Giri et al., 87–92 (2019).
- [393] A. M. Sirunyan et al., “Search for invisible decays of a Higgs boson produced through vector boson fusion in proton-proton collisions at $\sqrt{s} = 13$ TeV”, Phys. Lett. B **793**, 520–551 (2019), arXiv:1809.05937 [hep-ex].
- [394] V. Bertacchi, “Development and performance of the track finder for the Belle II Vertex Detector”, tesi di laurea mag. (Pisa U., 2017).